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ABSTRACT

A two-phased study was conducted to determine the feasibility of training drivers to acquire skills needed to avoid critical conflict motor vehicle accidents, and to develop the procedures and materials necessary for such training. Basic data were derived from indepth accident investigations and task analyses of driver behavior. Principal products/activities of the study (developed in phase II) were (1) a comprehensive curriculum and performance measurement specification (which includes seven modules) adaptable to local needs and resources; (2) definition, development, and preliminary testing of a bimodal simulator which can be used for training drivers in key collision avoidance skills; (3) definition of an Advance Driving Range concept, and (4) identification of research problems. This report is divided into four sections. Introductory and background material is included in section 1. Section 2 is a discussion of the components of phase 1--accident and task and behavioral analyses, and collision avoidance experiments. A discussion of phase 2 components (section 3) covers training/testing requirements definition, simulator definition and development, and the driving range concept. Also included are conclusions/recommendations and future research and development requirements. Appendixes include a bibliography of accident avoidance skill training literature; (2) curriculum and performance measurement specifications for accident avoidance skill training (seven modules), and (3) bimodal simulator descriptive materials. (LAS)

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Contract No. DOT-HS-4-00960
March 1976
Final Report

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16. Abstract

The purpose of this 2-phased study was to determine the feasibility of training drivers to acquire the skills needed to avoid critical conflict motor vehicle accidents, and to develop the procedures and materials necessary for such training. Basic data was derived from conduct of in depth accident investigations and task analyses of driver behavior. A specification was prepared for curriculum development and performance measurement, and a prototype bimodal simulator was developed as a training tool for acquisition of key perceptual and decision making skills. A concept was also defined for behind-the-wheel training on an Advanced Drivers Range. Results to date indicate that the program should continue to complete materials development and training of drivers.

17. Key Words
Driver Training; Accident Avoidance; Traffic Safety; Driver Education; Accident Analysis; Task Analysis; Driving Simulators; Collision Avoidance

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PREFACE

This report culminates an effort which the authors hope will be a beginning of a determined effort by the National Highway Traffic Safety Administration and the nation's traffic safety researchers to enable drivers to avoid killing themselves - and others - with a four-wheeled weapon. It is believed that a modicum of progress has been made toward that goal, although the dedicated efforts of all interested parties will be required for the long pull ahead. The research which is described in this report has had the benefit of a great many prior studies of related issues; the results and methodologies were taken advantage of in this study as much as possible. In addition, some rather unique approaches have been developed; only time and application will tell whether they will further advance the progress toward accident avoidance.

This project was supported by the National Highway Traffic Safety Administration under Contract No. DOT-HS-4-00960. The project manager and the principal investigator during the latter part of the study were, respectively, G. Richard Hatterick, Manager of the URS/Matrix Co., Capital Division, and James R. Bathurst, Research Scientist at the Huntsville, Alabama Division.

Special appreciation must be expressed for the guidance and patience of Mr. Herbert R. Miller who was the contract technical manager for this study, without whom the modest results achieved would not have been possible.

The authors also wish to acknowledge, with thanks, the contributions of Dr. Richard F. Pain, who served as project manager and principal investigator during Phase I of the study; Dr. A. James McKnight, who directed the portion of the study accomplished by Central Missouri State University; and Mr. Ronald W. Drahos and Mr. John R. Treat, who directed the accident data analysis performed by the Institute for Research in Public Safety of Indiana University.

An additional expression of gratitude is in order for the cooperation received from Mr. James B. Kelly, Manager of the Washington Office of Doron Precision Systems, Inc., who made available one of their simulator driver stations for use on the project.

Finally, many thanks and apologies are tendered to Mrs. Cheryl Rothbart and Mrs. Bess Smith who provided the secretarial support which has made this report possible.

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1.0 INTRODUCTION AND SUMMARY

The URS/Matrix Company was contracted by the NHTSA (Contract No. DOT-HS-4-00960) to prepare a program for driver skill training in accident avoidance techniques. While there was no opportunity to resolve some of the significant research questions which were raised during the conduct of the program, or to incorporate the results of such research into the development program, thereby increasing the validity of the final product, the first two phases of the program are now complete.

1.1 BACKGROUND

The current program in accident avoidance skill training stems principally from the realization by DOT/NHTSA(1) that none of the prior and current driver training programs have been shown to be effective in reducing the large numbers of critical conflict* accidents. As a result, the NHTSA wanted to determine whether drivers could be trained to avoid such accidents and, if so, develop an effective program designed specifically to train drivers in accident avoidance techniques.

In July, 1974 a contract encompassing two phases of a contemplated four-phase research program was awarded to URS/Matrix. The basic purpose of the program was to investigate the feasibility of training drivers to be able to avoid imminent automobile accidents and to develop the methods and materials necessary to accomplish such training. The purpose of each phase was as follows:

1) Phase I - Identify behavioral requirements for a representative set of accident avoidance situations.
2) Phase II - Develop and test training materials and prepare a plan for evaluating them in an operational setting.

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*Critical conflict is defined as one where (a) there is a conflict between two road users that will result in a collision unless at least one of the two parties responds correctly and (b) there is a possiblity that a collision can be avoided or ameliorated if one party makes a correct response, and (c) there is a compressed time interval which precludes recourse to "normal" driving skills.

(1) _Transcript of Proceedings: Workshop on Advanced Driver Education Techniques_, Department of Transportation, National Highway Traffic Safety Administration, Research Institute, Office of Driver Performance Research, January 21, 1972.

3) Phase III - Evaluate training/testing procedures in an operational setting.

4) Phase IV - Specify training/testing procedures and materials for additional target groups.

The URS/Matrix approach to the program depended heavily on the usefulness of data from ongoing, DOT-sponsored accident investigation programs and the apparent absence of any requirements for advancing the state-of-the-art of driver training technology. It was assumed that selected portions of existing driver training programs and techniques could be assembled into a coherent accident avoidance skill training curriculum when - and if - the pre-accident conditions and the driver behavior requirements were adequately identified and described.

1.2 PROGRAM SUMMARY

Phase I of this project, the requirements analysis phase, utilized a three-member team to determine the accident and pre-accident characteristics, identify the driver behavior requirements, and assess the feasibility of achieving the objectives of the program.

In preparing to determine the feasibility of developing such a training program, URS/Matrix solicited the assistance of the Institue for Research in Public Safety (IRPS) of Indiana University. Under subcontract to URS/Matrix, IRPS conducted an in-depth analysis of accident situations based on the MDAI accident data base developed for NHTSA during tri-level studies over a five year period.

This was done to find out if the accidents in question were identifiable, classifiable, and avoidable. While difficulties encountered delayed the completion of their investigation, and restricted somewhat both the depth and breadth of that portion of the study, the IRPS was able to develop situation and maneuver taxonomies and frequency data for a large number of multivehicle accident situations, and a loose hierarchy of potentially successful avoidance strategies.(2) In parallel with the IRPS investigation, another subcontractor, the National Public Services Research Institue (NPSRI) of Central Missouri State University (CMSU), conducted task and behavioral analyses of a set of potential accident situations to independently identify the knowledge, skill, behavior and maneuvering requirements for successfully avoiding an accident or collision.(3) The correlation between the results of these parallel studies was very close. Both studies recognized the absence or weakness of some types of data which would enable a firm prediction of training feasibility. Nevertheless, it was concluded as a result of the Phase I studies that it was potentially feasible to train drivers to avoid automobile multivehicle collisions, especially if some of the questions raised during the Phase I studies could be resolved through additional research. A plan for Phase II was prepared which proposed to expand some portions of the training feasibility program in order to answer some of the research questions and increase confidence in the final products of Phase I and II. Approval of the Phase II Work Plan, however, did not include the proposed optional efforts. Consequently, Phase II was initiated based on the guidelines projected at the beginning of Phase I and on the results achieved during Phase I.

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(2) An Analysis of Emergency Situations, Maneuvers, and Driver Behaviors in Accident Avoidance: Final Report, (P.O. #120-0004), Institute for Research In Public Safety, Indiana University, February 14, 1975.

The initial task in Phase II, that of preparing a candidate curriculum and performance measurement specification, was accompanied by many difficulties. Surveying the driver education literature for techniques to be used for training the critical conflict maneuvers identified in Phase I resulted in two fundamental conclusions:

1) That the most effective way to develop basic vehicle operating skills is through behind-the-wheel, real world practice;
2) That current fixed base and driving range based simulations do not provide the breadth of high fidelity perceptual cues necessary to support the development of critical driver skills in data acquisition, strategy selection and strategy implementation.

Practicing accident avoidance techniques and strategy selection on the open road (or on the driving range for that matter) using two or more real cars presents an unacceptably high risk. Therefore, such a technique could not seriously be considered for implementation in the training program being developed. For this reason, some method of conflict simulation was determined to be necessary. A survey of simulator state-of-the-art revealed that there were no entirely suitable simulators available to support the training requirements, and that those which provide the highest fidelity simulation had an accompanying exorbitantly high cost. It thus became necessary for URS/Matrix to conceptualize and begin implementing a new training technology.

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(3) Analysis of Requirements Imposed Upon Drivers by Collision Avoidance Situations, (P.O. #120-0005); National Public Services Research Institute, Central Missouri State University; February, 1975.

The first attempt to specify the training program followed a traditional approach of curriculum development for driver education programs. It was readily apparent, however, that the resulting specification would neither adequately identify the methods and procedures to be used nor provide the basis for development of materials and equipment to meet course objectives. A second Specification(4), reformatted and much more specific and detailed, was then developed, calling for a modularized training/testing program and identifying specific resources needed for the program. The final version of this specification is included as Appendix B.

Based on the early identification of the need for a driving simulator which would provide visual feedback to the operator of the dynamics of a multivehicle conflict situation, a "bimodal" driving simulator was defined, and subsequently developed in a prototype configuration. In addition, efforts were initiated to prepare, procure, or otherwise provide the other materials needed for the specified Accident Avoidance Skill Training (AAST) program. As part of this effort, a method was defined which will permit simulation of multi-vehicle conflicts on a driving range without the risks inherent in potential two-car collisions.

Throughout this process, in both Phase I and Phase II, questions and problems were identified which could significantly impact the outcome of the program. Unfortunately, the resources and time were not available to resolve the more significant research problems and issues, or to permit the development of a complete training program.

Section 2.0 of this report discusses the findings of Phase I of the study, and presents the basis upon which Phase II of the program was initiated. Section 3.0 discusses the activities and findings of Phase II, with particular emphasis on describing the bimodal simulator and advanced driving range concepts. Section 4.0 of this report presents a technical discussion of the research questions and issues which have been raised, with recommendations for future program efforts.

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(4) Preliminary Curriculum and Performance Measurement Specification for Accident Avoidance Skill Trianing and Performance Testing, Contract DOT-HS-4-00960, URS/Matrix Company, PR-0530-19, September 12, 1975.

2.0 PHASE I - REQUIREMENTS ANALYSIS

2.1 PHASE I OVERVIEW

Phase I of the Accident Avoidance Skill Training and Performance Testing program was devoted to analyzing the events immediately preceeding a crash, and deriving the behavioral requirements necessary to avoid the crash.

A two-pronged attack was made on the problem as illustrated in Figure 2-1. The Indiana University Multi-Disciplinary Accident Investigation (MDAI) file with 372 accidents (involving 613 drivers) was the data base for developing a conflict situation taxonomy, avoidance maneuver taxonomy, frequencies of occurrence, probabilities of maneuver success, and typical driver errors. Concurrently and in parallel the National Public Services Research Institute of Central Missouri State University applied task and behavior analysis techniques to the problem. Their basic data sources were the Driver Education Task Analysis, published accident figures and the traffic safety research literature. The combined use of these two approaches resulted in a more complete picture of the frequency of conflict situations and the behaviors necessary to avoid the situations than would have been possible by either approach alone. This is possibly the first time complementary use was made of accident and task analyses to achieve a common objective in the traffic safety arena.

As expected, both analyses contributed information for entering Phase II of the project but not without raising several important and unanswered questions. Some of the questions were addressed in the Phase I experimentation. However, as happens with most research, additional questions were discovered which could not be addressed in Phase I. Thus, Phase I accomplished the specified objectives but the experimentation needed to be continued in Phase II concurrently with training development activities.

The reports from the two subcontracted study efforts described above (2, 3) have previously been submitted. The discussion here is a condensation and synthesis of the findings of those two studies and presentation of conclusions and recommendations which were the basis for entering Phase II of the program.

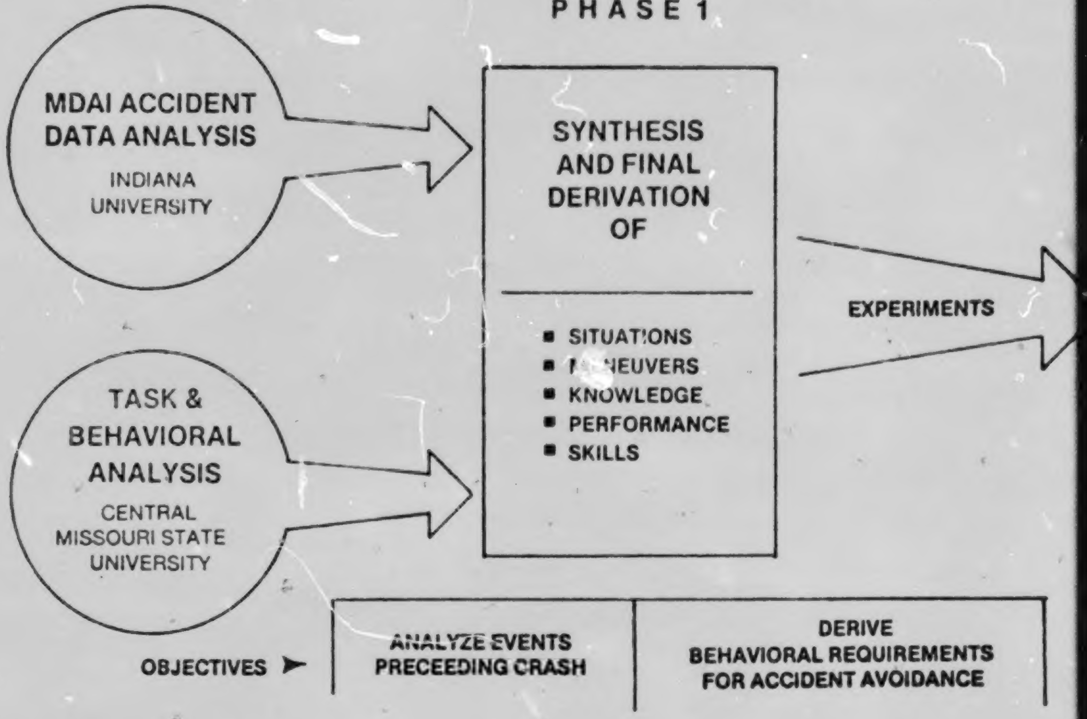
2.2 ACCIDENT DATA ANALYSIS

This section is a condensation of the final report of a study entitled "An Analysis of the Emergency Situations, Maneuvers, and Driver Behaviors in

FIGURE 2-1

STUDY APPROACH

PHASE 1



MDAI ACCIDENT DATA ANALYSIS

INDIANA UNIVERSITY

TASK & BEHAVIORAL ANALYSIS

CENTRAL MISSOURI STATE UNIVERSITY

SYNTHESIS AND FINAL DERIVATION OF

- SITUATIONS
- MANEUVERS
- KNOWLEDGE
- PERFORMANCE
- SKILLS

EXPERIMENTS

OBJECTIVES ➤

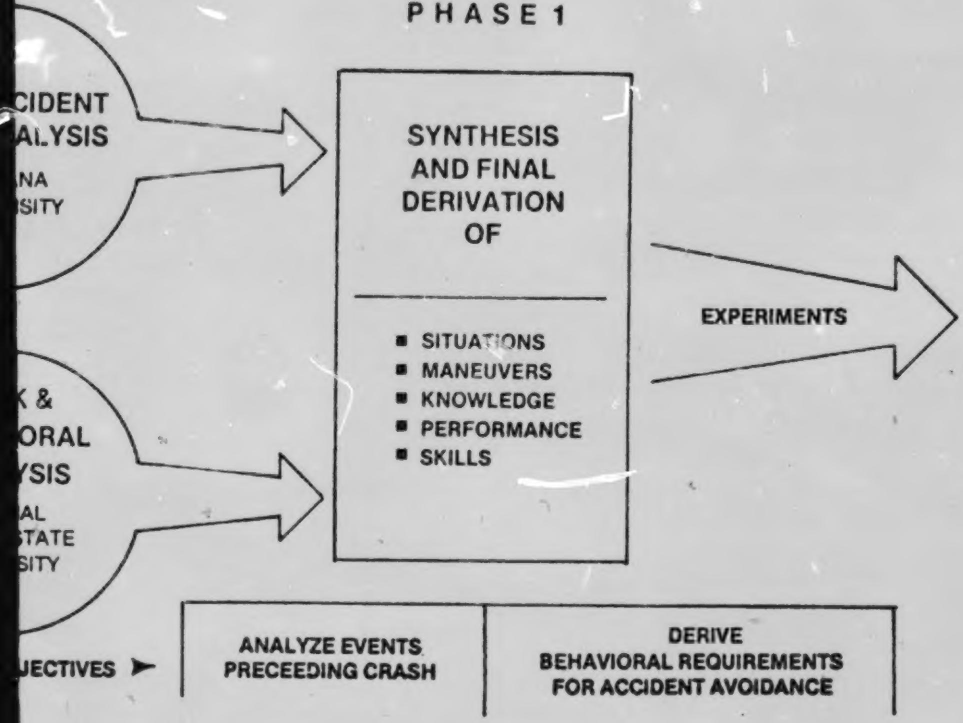
ANALYZE EVENTS PRECEEDING CRASH

DERIVE BEHAVIORAL REQUIREMENTS FOR ACCIDENT AVOIDANCE

FIGURE 2-1

STUDY APPROACH

PHASE 1


CIDENT
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SYNTHESIS AND FINAL DERIVATION OF
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MANEUVERS
KNOWLEDGE
PERFORMANCE
SKILLS
EXPERIMENTS
JECTIVES
ANALYZE EVENTS PRECEEDING CRASH
DERIVE BEHAVIORAL REQUIREMENTS FOR ACCIDENT AVOIDANCE

Accident Avoidance"(2). This study was performed by the Institute for Research in Public Safety (IRPS) of the Indiana University School of Public and Environmental Affairs, under contract to the URS/Matrix Company.

The IRPS effort involved the development of taxonomies of both accident situations and vehicle maneuvers that might be taken to avoid accidents. Attention was focused particularly on the "emergency traffic conflict" situations. These involve more than one roadway user and require rapid and unplanned actions to avoid collision. Subjective estimates of the probabilities of accident avoidance "success" have been developed for all feasible combinations of emergency situations and maneuvers.

2.2.1 Objectives

The general objective of this project was to perform an empirical analysis of in-depth accident case histories so as to: (1) analyze the events which immediately precede a crash, and (2) derive driver behavioral requirements for accident avoidance imposed by a high-probability set of those events.

The specific objectives of this study were to:

(1) Develop a taxonomy of emergency traffic conflict situations,
(2) Develop a taxonomy of evasive maneuvers available to a driver appropriate to each of the above identified situations,
(3) Identify the critical driver behaviors which comprise each of the above evasive maneuvers available to a driver,
(4) Determine the probability of occurrence for each category of emergency situation identified above,
(5) Determine for each category of evasive maneuver/emergency situation the probability that a driver would successfully avoid a traffic accident by instituting that maneuver in its given situation,
(6) Determine for each critical driver behavior comprising an evasive maneuver the probability or frequency of occurrence of each behavior, and
(7) State the findings of the project in terms of the required behavioral responses necessary for accident avoidance in emergency situations.

2.2.2 Methods and Procedures

The data base used in the study was the IRPS files of in-depth investigations of traffic accidents. These files were built during a five-year period (1970-1974) spanning two distinct tri-level accident studies sponsored by the National Highway Traffic Safety Administration (Contract Nos. DOT-HS-034-2-263 and DOT-HS-034-3-535). (5, 6, 7, 8)

The files contain over 400 accidents, and consist of both case summaries and raw data contained in original data collection instruments. The case summaries provided condensed information about the accidents which was augmented by transcripts of driver interviews prepared as a part of the in-depth investigations. Eventually, 372 cases were available for analysis.

The primary focus of the project was on identifying the best alternative actions that a driver, in an emergency conflict situation, can take to avoid a traffic accident. First, meaningful categories of emergency situations were developed and a set of vehicle "maneuvers" that might be taken to avoid accidents were specified. Subjective estimates of the probabilities of accident avoidance "success" were then developed for all feasible combinations of emergency situations and maneuvers. "Success" was defined as occurring when the maneuvering vehicle survived the encounter with no more than non-disabling minor damages (i.e., less than $100).

In order to determine the drivers' perception of danger, drivers were placed into two categories: (1) those who had time to attempt evasive action and (2) those who did not. Each sampled case was reviewed with respect to a perception dimension. Three basic categories emerged: (1) the driver was unaware of an impending collision and remained unaware of his predicament until

---

(5) Indiana University Institute for Research in Public Safety, Tri-level Study of the Causes of Traffic Accidents: Interim Report I, Contract No. DOT-HS-034-3-535, Report Nos. DOT-HS-801-334 & 335 (Vols. I & II), August, 1973.

(6) Indiana University Institute for Research in Public Safety, Tri-level Study of the Causes of Traffic Accidents, Interim Report II, Contract No. DOT-HS-034-3-535, 1975.

(7) Joscelyn, K.B., and J.R. Treat, Interim Report of a Study to Determine the Relationship Between Vehicle Defects and Crashes: Methodology, Institute for Research in Public Safety, Indiana University, Contract No. DOT-HS-034-2-263, Nov. 1, 1971.

(8) Joscelyn, K.B., and J.R. Treat, Results of a Study to Determine the Relationship Between Vehicle Defects and Crashes, Final Report, Institute for Research in Public Safety, Indiana University, Contract No. DOT-HS-034-2-263, Nov 1, 1972.

after the collision; (2) the driver was unaware of an impending collision until just before impact; and (3) the driver realized his predicament late in the accident sequence but was not able to make any significant effort toward avoidance.

EMERGENCY SITUATIONS: Emergency situation categories were developed in the form of a situation taxonomy. The relative frequency of occurrence of each situation category was also provided. Traffic accidents were reviewed, but situation classifications were made for each driver. The situation probabilities were derived as sample percentages of the achieved situation frequencies. After all available in-depth cases had been reviewed, the taxonomy consisted of a large (20-30) number of situation category descriptions. The situation categories were placed into four groups classified by key factors with which the driver had to cope.

The key factor in the first group was the driver's vehicle. All drivers in this group faced vehicle performance problems of such a magnitude as to intervene in the driver's crisis. The intervention was considered to occur at the point where the vehicle degradation became the driver's most immediate crisis.

Group two involved environmental problems, and drivers placed in group two had to first deal with the environment. Items defined as environmental included non-driven vehicles, non-vehicular traffic units, animals, and various natural and man-made obstacles.

Group three contained all situation categories in which one driver must attempt to avoid another driver. This group was considered to be of prime importance. The fourth group was a miscellaneous group, composed of two drivers who could not otherwise be classified.

Determination of the situation frequencies and probabilities followed easily. The results were obtained from a simple tabulation of the situation category ledgers.

MANEUVER TAXONOMY: The maneuver taxonomy, like the situation taxonomy, was subjectively determined. A maneuver was defined as a two-stage phenomenon involving both a path selection and the selection of some appropriate driving behavior along that path. During the analysis of driver actions to avoid the accident, two recording techniques were used: (1) a simple description of driver actions, and (2) a coding scheme developed prior to the initiation of this project. Each driver's attempted avoidance actions were examined and summarized on a special ledger with the applicable emergency situation.

A maneuver was defined as the instantaneous change in a vehicle's velocity vector that results from the driver's perception that the vehicle's present velocity will result in a traffic accident. Each maneuver consisted of a combination of path selection (direction) and braking or accelerating (speed change) along the chosen path. In all, 32 maneuvers were finally identified, including an "other" category.

MANEUVER PROBABILITIES: To estimate which driver actions are best in a given situation, a procedure was developed for assessing the probability of success given a specific situation and a specific maneuver. The procedure also included an assessment of the environment regarding the conduciveness of the environment for avoiding an accident. After the procedures were specified and data collection instruments developed, the assessments were performed by IRPS accident causation analysts and the consistency of the assessments was evaluated. Some reassessments were required in order to obtain data consistency. Probability estimates were then developed from the data.

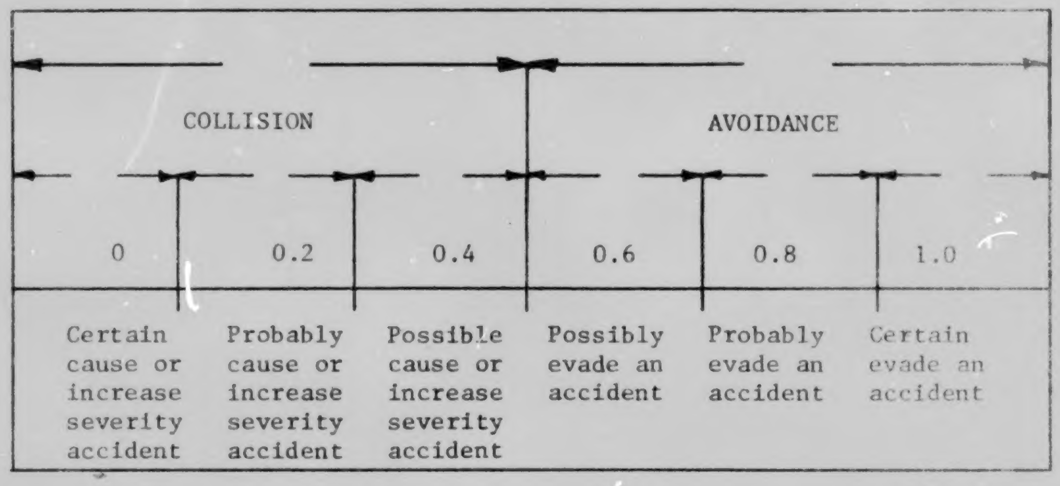
The rating procedure employed required the rater to select one of six possible outcomes for each maneuver (see Figure 2-2). Maneuver "success" probabilities ranging from zero to one were assigned to the maneuver outcome categories (in .2 increments) for later conversion of the qualitative judgments to numbers. A successful maneuver was defined as one resulting in no more than $100 property damage and no injuries.

Two additional assessments were also conducted to complement the subjective probability assessments. In the first, the raters were asked to ascertain the probability that the horn's use would help a driver avoid an accident. The second complementary assessment involved an environment conduciveness rating. The raters were asked to make a dichotomous choice (yes or no) as to whether they believed that the environment (i.e., obstacles other than the other vehicle) would hinder or facilitate the driver's avoidance maneuver.

Computer programs were developed to produce the maneuver conditional probabilities. Two sets were produced -- one set for drivers who had time to attempt evasive action and the other for all drivers regardless of whether the driver had time for evasive action.

An environmentally conditioned set of maneuver probabilities was also calculated. The conditions on this set of probability estimates were: the situation, that the driver had time to attempt evasive action, and that the environment was conducive for evasive action. Only those drivers who had time to attempt evasive action were considered in this set.

FIGURE 2-2 MANEUVER PROBABILITY ASSESSMENT SCALE


COLLISION
AVOIDANCE
0
0.2
0.4
0.6
0.8
1.0
Certain cause or increase severity accident
Probably cause or increase severity accident
Possible cause or increase severity accident
Possibly evade an accident
Probably evade an accident
Certain evade an accident

ADDITIONAL ANALYSES: In addition to the analyses of emergency situations and maneuvers described above, several special analyses were conducted during the study. The so-called horn analysis was one of these. Another special analysis involved attempts to determine the percentage of drivers who by performing specified maneuvers, could have avoided crashes at various levels of certainty. Three such levels were considered in the analysis. The analysis also attempted to determine the percentage of accidents in each of the three certainty categories that could have been avoided had a specified maneuver been performed.

The last of the additional analyses undertaken was the driver-related error analysis. The data for this analysis was extracted from IRPS' tri-level accident investigation computerized files, which focus on the causes of traffic accidents. Causes are attributed to vehicular, environmental, and human factors. Among the human factors was a factor entitled "improper evasive action." The driver-related error analysis was concerned primarily with this factor. The objective was to determine the extent of driver-related errors among the drivers reviewed in this project. Specifically, attention was focused on drivers who were involved in an emergency conflict situation and had time to attempt evasive action. The identification of those situations in which driver-related errors occurred was also a goal.

2.2.3 Results of Accident Data Analysis

The principal results of the IRPS study were the situation taxonomy, maneuver taxonomy, situation frequencies, and maneuver success probabilities conditional upon the situation with which drivers had to cope. All results are presented in detail in the IRPS report (2). A summary of those results follows.

SITUATION TAXONOMY: The situation taxonomy and related frequencies are the culmination of the efforts of IRPS to characterize the pre-crash situations which faced the 613 drivers involved in the 372 traffic accidents examined in this study.

This taxonomy was empirically determined and is not implied to represent "the" unique way in which accident situations are to be classified. The categories were subdivided whenever it was believed appropriate, both to provide detail and to facilitate aggregation. Aggregation was required because of the need to conform to the assumptions which underlie the chi-square test. Table 2.1 presents the aggregation scheme used throughout the report.

The frequencies of occurrence associated with each major category are presented in Table 2.2. Table 2.3 presents the situation frequencies within Group 3.0, the group which represents the "traffic conflict situations" which were the principal focus of the study. The subcategories within this conflict situation group are as defined in Table 2.4.

TABLE 2.1 SITUATION AGGREGATION SCHEME

CATEGORY	SITUATIONS
Intersection	3.1-3.5
Head-on	3.6-3.7
Rear-end	3.8-3.9
Adjacent	3.10-3.13
Other	3.14-3.17

TABLE 2.2: SITUATION TAXONOMY BY MAJOR GROUP

SITUATION GROUP	VEHICLES INVOLVED		DID THE DRIVER PERCEIVE THE DANGER IN TIM EVASIVE ACTION?				
			YES				
	NO.	PERCENT OF TOTAL VEHICLES	NO. OF VEH.	PERCENT OF TOTAL VEH.	PERCENT OF SIT. GRP.	PERCENT OF TOTAL "YES"	NO. OF VEH.
1.0: Degraded vehicular performance causes or interferes with driver's ability to cope with an emergency situation.	21	3.43	11	1.79	52.38	3.11	10
2.0: Driver attempts to negotiate an emergency situation created by the environment and/or the driver.	102	16.64	78	12.72	76.47	22.03	24
3.0: Driver suddenly perceives that another vehicle is approaching on a collision course.	488	79.61	265	43.23	54.30	74.86	223
4.0: Other (1 drug reaction case; 1 unusual alcohol-intoxication case).	2	0.33	0	0.00	0.00	0.00	2
TOTAL	613	100.00	354	57.75	57.75	100.00	259

TABLE 2.2: SITUATION TAXONOMY BY MAJOR GROUP

	VEHICLES INVOLVED		DID THE DRIVER PERCEIVE THE DANGER IN TIME TO ATTEMPT EVASIVE ACTION?							
			YES				NO			
				PERCENT OF				PERCENT OF		
TION UP	NO.	PERCENT OF TOTAL VEHICLES	NO. OF VEH.	TOTAL VEH.	SIT. GRP.	TOTAL "YES"	NO. OF VEH.	TOTAL VEH.	SIT. GRP.	TOTAL "NO"
lar performance feres with y to cope cy situation.	21	3.43	11	1.79	52.38	3.11	10	1.63	47.62	3.86
to negotiate tuation created ent and/or the	102	16.64	78	12.72	76.47	22.03	24	3.92	23.53	9.27
perceives that is approaching course.	488	79.61	265	43.23	54.30	74.86	223	36.38	45.70	86.10
eaction case; ol-intoxi-	2	0.33	0	0.00	0.00	0.00	2	0.33	100.00	0.77
	613	100.00	354	57.75	57.75	100.00	259	42.25	42.25	100.00

TABLE 2.3: SITUATION TAXONOMY BY SUBCATEGORIES OF SITUATION GROUP 3.0

SITUATION GROUP 3.0 SUBCATEGORIES*	VEHICLES INVOLVED		DID THE DRIVER PERCEIVE THE DANGER IN TIME TO ATTEMPT						
			YES				NO		
	NO.	PERCENT OF TOTAL VEHICLES	NO. OF VEH.	PERCENT OF			NO. OF VEH.	PERCE	
				TOTAL VEH.	SIT. GROUP	TOTAL "YES"		TOTAL VEH.	SI GR
3.1	80	16.39	67	13.73	83.75	25.28	13	2.66	1
3.2	58	11.89	30	6.15	51.72	11.32	28	5.74	4
3.3	5	1.02	4	0.82	80.00	1.51	1	0.20	2
3.4	57	11.68	25	5.12	43.86	9.43	32	6.56	5
3.5	32	6.56	4	0.82	12.50	1.51	28	5.74	8
3.6	27	5.53	16	3.28	59.26	6.04	11	2.25	4
3.7	34	6.97	27	5.53	79.41	10.19	7	1.43	2
3.8	62	12.70	50	10.25	80.65	18.87	12	2.46	1
3.9	64	13.11	11	2.25	17.19	4.15	53	10.86	8
3.10	19	3.89	13	2.66	68.42	4.91	6	1.23	3
3.11	16	3.28	2	0.41	12.50	0.75	14	2.87	8
3.12	9	1.84	5	1.02	55.56	1.89	4	0.82	4
3.13	7	1.43	1	0.20	14.29	0.38	6	1.23	8
3.14	4	0.82	3	0.61	75.00	1.13	1	0.20	2
3.15	7	1.43	6	1.23	85.71	2.26	1	0.20	1
3.16	5	1.02	0	0.00	0.00	0.00	5	1.02	10
3.17	2	0.41	1	0.20	50.00	0.38	1	0.20	5
TOTAL 3.0	488	100.00	265	54.30	54.30	100.00	223	45.70	4

*See Table 2.4 for subcategory definitions.

TABLE 2.3: SITUATION TAXONOMY BY SUBCATEGORIES OF SITUATION GROUP 3.0

	VEHICLES INVOLVED		DID THE DRIVER PERCEIVE THE DANGER IN TIME TO ATTEMPT EVASIVE ACTION?							
			YES				NO			
				PERCENT OF				PERCENT OF		
S*	NO.	PERCENT OF TOTAL VEHICLES	NO. OF VEH.	TOTAL VEH.	SIT. GROUP	TOTAL "YES"	NO. OF VEH.	TOTAL VEH.	SIT. GROUP	TOTAL "NO"
	80	16.39	67	13.73	83.75	25.28	13	2.66	16.25	5.83
	58	11.89	30	6.15	51.72	11.32	28	5.74	48.28	12.56
	5	1.02	4	0.82	80.00	1.51	1	0.20	20.00	0.45
	57	11.68	25	5.12	43.86	9.43	32	6.56	56.14	14.35
	32	6.56	4	0.82	12.50	1.51	28	5.74	87.50	12.56
	27	5.53	16	3.28	59.26	6.04	11	2.25	40.74	4.93
	34	6.97	27	5.53	79.41	10.19	7	1.43	20.59	3.14
	62	12.70	50	10.25	80.65	18.87	12	2.46	19.35	5.38
	64	13.11	11	2.25	17.19	4.15	53	10.86	82.81	23.77
	19	3.89	13	2.66	68.42	4.91	6	1.23	31.58	2.69
	16	3.28	2	0.41	12.50	0.75	14	2.87	87.50	6.28
	9	1.84	5	1.02	55.56	1.89	4	0.82	44.44	1.79
	7	1.43	1	0.20	14.29	0.38	6	1.23	85.71	2.69
	4	0.82	3	0.61	75.00	1.13	1	0.20	25.00	0.45
	7	1.43	6	1.23	85.71	2.26	1	0.20	14.29	0.45
	5	1.02	0	0.00	0.00	0.00	5	1.02	100.00	2.24
	2	0.41	1	0.20	50.00	0.38	1	0.20	50.00	0.45
0	488	100.00	265	54.30	54.30	100.00	223	45.70	45.70	100.00

4 for subcategory definitions.

TABLE 2.4: SITUATION GROUP 3.0 SUBCATEGORIES (TRAFFIC CONFLICT SITUATIONS)

#	DEFINITION
3.0	Driver suddenly perceives that another vehicle is approaching on a collision course.
3.1	Driver, while traveling into an intersection (path or roadway), suddenly perceives another vehicle crossing in front in driver's path.
3.2	Driver, while traveling into an intersection (path or roadway), suddenly perceives that another vehicle is approaching towards driver's vehicle.
3.3	Driver, while traveling toward a roadway intersection, suddenly perceives first, a traffic control device requiring a stop, and second, another vehicle approaching on a collision course.
3.4	Driver, while entering an intersection (path or roadway), from a stopped or slowed condition, suddenly perceives that another vehicle is approaching towards driver's vehicle.
3.5	Driver, while entering an intersection (path or roadway), from a stopped or slowed condition, suddenly perceives another vehicle crossing in front in driver's path.
3.6	Driver allowed vehicle to infringe upon or in the opposing lane of travel; driver suddenly perceives another vehicle approaching from the opposite direction.
3.7	Driver, traveling in own lane, suddenly encounters another vehicle, coming from the opposite direction, infringing upon or in driver's path.
3.8	Driver suddenly perceives that another vehicle has slowed or stopped ahead.
3.9	Driver is slowing or stopped when suddenly another vehicle, approaching from the rear, creates a danger for driver.
3.10	Driver, traveling in own lane or passing suddenly perceives that another vehicle, traveling in the same direction, is veering into the driver's path.
3.11	Driver, while turning or changing lanes, suddenly perceives that another vehicle, from the same direction, is occupying the adjacent lane.
3.12	Driver, while traveling in own lane, suddenly encounters another vehicle pulling into driver's path from a curb or intersection (path or roadway).
3.13	Driver, while entering the travel lanes from the curb or an intersection (path or roadway), suddenly perceives that another vehicle is on a collision course with driver's vehicle.
3.14	Driver, while traveling into an intersection, suddenly encounters a stopped vehicle in driver's path.
3.15	Driver is stopped in own lane at a roadway intersection when suddenly another vehicle approaches towards driver's vehicle.
3.16	Driver, while backing (on roadway, from curb or driveway), suddenly perceives another vehicle in or crossing driver's path.
3.17	Driver, while traveling in own lane, suddenly encounters another vehicle backing into driver's path from the curb or a driveway.

In Tables 2.2 and 2.3, numerical and percentage distributions are provided for both the situation in total (all drivers considered), and for only those drivers in a particular situation, who had time to attempt evasive action (see Section 2.2.2 for discussion of what constituted "time to attempt evasive action"). Of the 223 drivers in group 3.0 who did not have time to attempt evasive action, 105 drivers (47%) were totally unaware of the impending impact. The number of drivers who reported that they did not have time was a substantial part of the remaining 118 group 3.0 drivers. The criteria used in deciding whether a driver should be classified as having insufficient time was subjective because the amount of time a driver had was not available from the data. It was decided that there must have been less than ten feet of pre-impact skidmarks, and the vehicle must have been traveling at least twenty miles per hour. The driver interviews were the chief source of data regarding this question, provided of course that driver statements were not contradicted by skidmarks or other physical evidence.

REPRESENTATIVENESS OF SITUATIONS: Among the 613 accident drivers who comprised the sample in this study, many different types of accident situations were encountered. The degree to which these situations are representative of those faced by accident-involved drivers nationally, especially emergency traffic conflict situation, is of importance in assessing the degree to which study results can be generalized to the national accident picture. Unfortunately, comparable national data does not exist for comparison.

As a part of its tri-level studies, IRPS has carefully examined its accident samples, and made comparisons between variables describing these samples and the same descriptors for both Monroe County and national accidents (5, 6, 8). Generally speaking, in terms of such variables as accident place of occurrence, road surface condition, and accident severity, both the study area and tri-level accident samples have been found quite similar to the national distribution. The primary concern was whether the types of emergency traffic conflicts differed from those experienced nationally. Also of concern was whether the nature and extent of environmental constraints were similar to those experienced nationally, as these affect the maneuver success probabilities. Again, no direct measures as to the representatives of these situations are available. However, the similarity between the accident samples, county accidents, and similar data for the nation indicate that the study area and samples are certainly not unique or atypical, and that the situations faced by study drivers probably parallel quite closely those experienced by drivers nationally. A notable exception to this may be that Monroe County does not provide representation of the freeway or interstate-type highway driving environment which may account for a small but important (and possibly unique) portion of reported national accidents.

Although the difficulties of providing a definitive answer to the representativeness question have been indicated, some insight into the question are provided by Table 2.5 which presents both Monroe County and national data regarding the distribution of reported accidents according to "accident type", in comparison to the IRPS data. Most of the emergency traffic conflict accidents were of the "collision with other motor vehicles" type, and it may be seen in Table 2.5 that for the three years shown, 74% of county accidents have been of this type. This compares with 64% for the two years of national data presented, and 68% of the IRPS accidents. Unfortunately, the "accident type" grouping obscures the distinctions among emergency conflict situations which are of interest. However, accident definitions may be developed comprised of combinations of the situations faced by each of the drivers in these accidents, and some of these combinations (describing accidents) may then be fitted within the "accident type" breakdown, providing a partial comparison. Of the 372 accidents in the IRPS file, only 316 could be fit within the 1971-1973 time frame of the national and Monroe County data.

Examination of the comparisons in Table 2.5 indicates a very close "fit" in some instances, and significant differences in others. To some extent inconsistencies are believed due to differences in categorizing specific accidents. Although results of these comparisons are inconclusive, it certainly would not be accurate to conclude that the study samples were non-representative. One problem is that the "accident type" variable groups together the distinctions between situations which are really of interest. Another problem is that the distribution is contaminated by the presence of a single attribute which contains greater than 65% of the observed values (i.e., the collision with other motor vehicle attribute).

In summary, it is believed that the accidents studied have provided a reasonably representative mix of situations, with the primary exception of not having considered those unique to interstate highway or freeway type environments.

TABLE 2.5: COMPARISON OF ACCIDENT CATEGORY DISTRIBUTION

CATEGORY	UNITED STATES*		MONROE COUNTY*		
	N	%	N	%	N
Collision with pedestrian	122,784	2.49	114	1.08	
Collision with other non-motor vehicle	179,903	3.65	88	.84	
Other collision and non-collision	1,464,135	29.71	2,567	24.45	9
Collision with other motor vehicle(s)	3,162,170	64.15	7,731	73.63	21
TOTAL	4,928,992	100.0	10,500	100.0	31

*Sources: Unites States - National Accident Summary File, 1971 & 1972 Statistics.
Monroe County, Indiana - Indiana State Police Statistics, 1971, 1972 & 1973.
IRPS - References 5, 6, 7 and 8.

TABLE 2.5: COMPARISON OF ACCIDENT CATEGORY DISTRIBUTION

GORY	UNITED STATES*		MONROE COUNTY*		IRPS*	
	N	%	N	%	N	%
ith pedestrian	122,784	2.49	114	1.08	6	1.90
ith other vehicle	179,903	3.65	88	.84	2	0.63
sion and sion	1,464,135	29.71	2,567	24.45	94	29.75
ith other icle(s)	3,162,170	64.15	7,731	73.63	214	67.72
	4,928,992	100.0	10,500	100.0	316	100.0

nites States - National Accident Summary File, 1971 & 1972 Statistics.
onroe County, Indiana - Indiana State Police Statistics, 1971, 1972 & 1973.
RPS - References 5, 6, 7 and 8.

MANEUVER TAXONOMY: A maneuver was conceptualized as a combination of path selection (direction) and braking or accelerating along the chosen path (change in speed). The conceivable combinations of path and speed are many, and by necessity a limited set was chosen. A maneuver taxonomy was developed comprised of thirty-two maneuvers (Table 2.6) for use with the group of situations defined as emergency conflicts (Situation Group 3.0). The first digit of each maneuver refers to the selected path. Path is composed of combinations of direction and driver intention. The second digit refers to the manner and type of change in speed. Maneuver 0.0 is the null maneuver (steering straight at constant speed). It generally requires the driver to do nothing different from what he/she was doing.

Some of the maneuvers are self explanatory; others are more difficult to interpret. Maneuver 0.4 is straightforward, and involves accelerating while steering straight ahead. Maneuvers 1.1 and 1.3 involve steering straight ahead while trying to stop. Of these, Maneuver 1.1 involves driver braking, while Maneuver 1.3 involves the driver applying a combination of braking and decelerating. "Decelerating" implies intentional lessening of the pressure on the accelerator, and/or an intentional placement of the transmission into a gear lower. The combination "braking and decelerating" can occur in any sequence (e.g., brake, decelerate without braking, brake).

Values six through nine for the first digit require an initial steer either left or right, followed by an opposing steer to return the vehicle to a safe course. In developing this taxonomy, there was an underlying assumption that the maneuvers developed should be presented in terms of initial driver responses. However, the fact that the driver may be required to employ subsequent combinations of path and speed change for successful avoidance has not been ignored. The raters of the maneuver success probabilities (see below) were instructed to consider the secondary obstacles which might preclude success for the various maneuvers. The success or failure associated with each maneuver took into consideration the rater's assessment of the environment's conduciveness for avoiding the accident.

Maneuver 10.4 implies that a driver, while stopped or at very low speed places the transmission in a gear which is the reverse of the gear in which the transmission was placed at the time the driver perceived the danger. Acceleration (forward or rearward) and straight steering then follow.

TABLE 2.6: MANEUVER TAXONOMY

MANEUVERS

0.0
0.4
1.1
1.3
2.1
2.2
2.3
2.5
3.1
3.3
4.1
4.2
4.3
4.5
5.1
5.3
6.0
6.1
6.2
6.3
6.4
7.1
7.3
8.0
8.1
8.2
8.3
8.4
9.1
9.3
10.4
Other

PATH

DIRECTION:

Steer straight only
Steer straight then right
Steer straight then left
Steer right then straight
Steer left then straight

INTENT:

To continue past object
To stop before object
To reverse direction

COMBINATIONS:

0 = Steer straight only	To continue past object
1 = Steer straight only	To stop before object
2 = Steer straight then right	To continue past object
3 = Steer straight then right	To stop before object
4 = Steer straight then left	To continue past object
5 = Steer straight then left	To stop before object
6 = Steer right then straight	To continue past object
7 = Steer right then straight	To stop before object
8 = Steer left then straight	To continue past object
9 = Steer left then straight	To stop before object
10 = Steer straight only	To reverse direction

SPEED

0 = Constant
1 = Braking
2 = Decelerating
3 = Braking and decelerating combined
4 = Accelerating
5 = Decelerating then accelerating

*Combinations of direction and speed are expressed as a decimal, with "direction" to the left of the decimal, and "speed" to the right, e.g., 6.4: steer right then straight, with acceleration, to continue past object.

MANEUVER SUCCESS PROBABILITIES: Reference 2 includes the results of all ratings and calculations for maneuver success probabilities for all Group 3.0 drivers, as well as for only those group 3.0 drivers who had time to attempt a maneuver. In addition, both sets of probabilities are calculated for both the situation level (e.g., 3.1) and the subsituation level (3.1.1.1, 3.1.1.2, etc.). Recognizing, however, that this study is directed toward practical avoidance maneuvers, discussion herein is limited to the situation level, and only for those drivers who had time to attempt a maneuver.

The maneuver success probabilities contained in Table 2.7 are for drivers, in traffic conflict emergency situations, who perceived the danger in time to attempt evasive action. Each non-marginal cell indicates the mean "conditional" probability that will, upon application of the selected maneuver, result in the successful evasion of a traffic accident--given that a driver must cope with the cell's column situation. The minimum "condition" is the column situation which confronts the driver. The added condition is that the driver had time to attempt evasive action, the second set of estimates. The column of marginal probabilities (right margin of table) indicates the relative success of each maneuver independent of the driver's situation (i.e., The average success probability across all Group 3.0 situations). The row of marginal probabilities (bottom of table) represents an average success probability for a situation, across each of the 31 maneuvers. In a sense, it is thus a measure of how difficult or forgiving the situation is. Table 2.8 presents measures of each situation's distribution in terms of the distribution's central tendancy and dispersion. For each situation, the maneuver with the highest probability of success is indicated, and measures of the maneuver's distribution are presented.

From Table 2.8, situation 3.12 appears to be the situation which has the highest probability of evasion, followed by 3.3, 3.8, 3.7, and 3.6 (in descending order, with control for driver perception). Simply focusing on the means fails to adequately describe the distributions of these situations. The probability of successful evasion varies greatly among accidents/drivers classified as being of the same situation; for a given situation, the probability of evasion may vary greatly from accident to accident depending on environmental constraints and other existing circumstances. The same problem of skewness presents itself in the distributions of those maneuvers which have the highest success probabilities (right hand column, Table 2.8). The indicated maneuvers may be the best maneuvers on the average, but for some drivers these maneuvers are much better than for others depending on the circumstances of the accident.

TABLE 2.7

MANEUVER CONDITIONAL SUCCESS PROBABILITIES FOR DRIVERS WITH TIME TO ATTEMPT EVASIVE ACTION

	SITUATION																	
MANEUVER	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	3.10	3.11	3.12	3.13	3.14	3.15	3.16	3.17	3.0
0.0	.010	.027	.025	.016	.050	.063	.130	.008	.073	.015	.050	.040	.000	.067	.050	.000	.000	.034
0.4	.013	.120	.025	.204	.200	.019	.126	.008	.509	.000	.300	.040	.600	.033	.117	.000	.000	.085
1.1	.097	.107	.200	.104	.050	.081	.196	.108	.027	.054	.050	.160	.000	.333	.083	.000	.100	.109
1.3	.115	.123	.300	.116	.050	.081	.215	.136	.027	.100	.150	.200	.000	.300	.083	.000	.100	.128
2.1	.251	.227	.325	.124	.150	.425	.389	.384	.091	.146	.350	.200	.000	.133	.050	.000	.000	.266
2.2	.209	.193	.325	.120	.150	.419	.367	.368	.109	.162	.350	.220	.000	.100	.050	.000	.100	.247
2.3	.288	.247	.375	.132	.225	.525	.411	.422	.164	.215	.400	.240	.000	.167	.067	.000	.100	.304
2.5	.169	.153	.275	.104	.150	.394	.304	.298	.291	.108	.350	.180	.000	.067	.083	.000	.000	.213
3.1	.263	.227	.325	.116	.225	.350	.404	.380	.164	.254	.350	.220	.000	.200	.050	.000	.100	.275
3.3	.285	.247	.375	.120	.225	.412	.430	.424	.173	.315	.400	.260	.000	.200	.050	.000	.100	.303
4.1	.216	.177	.425	.060	.100	.063	.207	.266	.136	.162	.000	.540	.100	.533	.067	.000	.100	.195
4.2	.197	.177	.450	.052	.100	.069	.181	.258	.136	.215	.000	.560	.100	.467	.067	.000	.100	.189
4.3	.249	.210	.475	.064	.100	.069	.174	.276	.109	.269	.000	.600	.200	.567	.067	.000	.100	.214
4.5	.151	.197	.425	.060	.100	.037	.152	.210	.245	.085	.000	.560	.100	.500	.083	.000	.100	.165
5.1	.227	.180	.425	.068	.100	.069	.204	.290	.155	.162	.000	.540	.100	.600	.050	.000	.100	.205
5.3	.249	.200	.475	.064	.100	.075	.185	.304	.155	.269	.000	.600	.400	.633	.050	.000	.100	.222
6.0	.209	.180	.125	.136	.200	.438	.478	.366	.155	.100	.300	.140	.100	.100	.067	.000	.000	.254
6.1	.276	.220	.250	.104	.150	.475	.530	.426	.109	.123	.350	.180	.000	.133	.067	.000	.000	.293
6.2	.246	.197	.275	100	.125	.531	.504	.412	.100	.085	.350	.200	.000	.167	.067	.000	.000	.279
6.3	.300	.230	.300	.120	.125	.513	.541	.466	.127	.238	.400	.220	.000	.133	.067	.000	.100	.321
6.4	.182	.197	.150	.144	.200	.306	.426	.250	.691	.062	.250	.120	.800	.033	.183	.000	.100	.240
7.1	.285	.250	.325	.144	.150	.506	.522	.440	.118	.231	.300	.220	.000	.200	.050	.000	.100	.314
7.3	.306	.263	.300	.144	.175	.525	.552	.474	.118	.292	.350	.240	.000	.200	.067	.000	.100	.336
8.0	.163	.193	.125	.064	.050	.050	.130	.284	.055	.185	.050	.500	.300	.567	.067	.000	.100	.172
8.1	.216	.177	.350	.084	.050	.044	.174	.324	.136	.238	.050	.580	.200	.667	.050	.000	.100	.209
8.2	.197	.187	.175	.084	.050	.044	.148	.302	.136	.223	.050	.560	.200	.667	.050	.000	.100	.194
8.3	.242	.213	.450	.088	.050	.056	.178	.344	.145	.262	.000	.620	.100	.700	.050	.000	.100	.228
8.4	.119	.213	.275	.132	.050	.031	.111	.204	.355	.154	.350	.480	.300	.500	.083	.000	.100	.166
9.1	.230	.173	.425	.128	.050	.050	.185	.324	.155	.223	.000	.620	.200	.633	.050	.000	.100	.218
9.3	.251	.187	.450	.136	.050	.056	.185	.352	.155	.308	.000	.640	.100	.700	.050	.000	.100	.237
10.4	.088	.077	.075	.228	.275	.119	.159	.100	.018	.062	.150	.100	.500	.233	.333	.000	.000	.119
TOTAL	.203	.186	.299	.108	.123	.222	.287	.297	.166	.171	.184	.341	.142	.340	.076	.000	.074	.217

Conditions: The probabilities in this table are conditional upon the situation with which the driver had to cope and upon the amount of time in which the driver had to respond to the emergency situation (driver did perceive the danger in time to attempt evasive action).

TABLE 2.8

MANEUVER PROBABILITY SITUATION CENTRAL TENDENCY AND DISPERSION; HORN PROBABILITY (WITH CONTROL FOR DRIVER PERCEPTION)

SITUATION	MANEUVER PROBABILITY						HORN PROBABI
	MEAN	STANDARD DEVIATION	RANGE	HIGHEST MANEUVER	MEAN	STANDARD DEVIATION	
3.1	.203	.134	.296	7.3	.306	.318	.439
3.2	.186	.149	.236	7.3	.263	.311	.43
3.3	.299	.192	.450	4.3, 5.3	.475	.413	.30
3.4	.108	.121	.212	10.4	.228	.274	.20
3.5	.123	.120	.225	10.4	.275	.282	.15
3.6	.222	.102	.512	6.2	.531	.299	.24
3.7	.287	.127	.441	7.3	.552	.293	.42
3.8	.297	.176	.466	7.3	.474	.325	.31
3.9	.166	.172	.673	6.4	.691	.288	.13
3.10	.171	.108	.315	3.3	.315	.363	.48
3.11	.184	.150	.400	2.3, 3.3, 6.3	.400	.462	.05
3.12	.341	.112	.600	9.3	.640	.227	.58
3.13	.142	.036	.800	6.4	.800	.283	.70
3.14	.340	.084	.667	8.3, 9.3	.700	.329	.46
3.15	.076	.102	.283	10.4	.333	.323	.31
3.16	.000	.000	.000	--	.000	.000	.00
3.17	.074	.105	.100	Numerous	.100	.141	.90
3.0	.217	.154	.302	7.3	.336	.329	.36

*Horn probability: The probability that use of the horn would help the driver avoid
if used in its best circumstance.

TABLE 2.8

R PROBABILITY SITUATION CENTRAL TENDENCY AND DISPERSION; HORN PROBABILITY (WITH CONTROL FOR DRIVER PERCEPTION)

MANEUVER PROBABILITY						HORN PROBABILITY*
MEAN	STANDARD DEVIATION	RANGE	HIGHEST MANEUVER	MEAN	STANDARD DEVIATION	
.203	.134	.296	7.3	.306	.318	.439
.186	.149	.236	7.3	.263	.311	.433
.299	.192	.450	4.3, 5.3	.475	.413	.300
.108	.121	.212	10.4	.228	.274	.200
.123	.120	.225	10.4	.275	.282	.150
.222	.102	.512	6.2	.531	.299	.244
.287	.127	.441	7.3	.552	.293	.426
.297	.176	.466	7.3	.474	.325	.310
.166	.172	.673	6.4	.691	.288	.136
.171	.108	.315	3.3	.315	.363	.485
.184	.150	.400	2.3, 3.3, 6.3	.400	.462	.050
.341	.112	.600	9.3	.640	.227	.580
.142	.036	.800	6.4	.800	.283	.700
.340	.084	.667	8.3, 9.3	.700	.329	.467
.076	.102	.283	10.4	.333	.323	.317
.000	.000	.000	--	.000	.000	.000
.074	.105	.100	Numerous	.100	.141	.900
.217	.154	.302	7.3	.336	.329	.362

bility: The probability that use of the horn would help the driver avoid an accident if used in its best circumstance.

Tables 2.9 and 2.10 present the best and worst maneuvers respectively for the eight most frequent situations, and the average maneuver successes across all conflict situations (Group 3.0). The maneuvers having the highest averages across all situations involve right steering (delayed or immediate) and non-braked deceleration in combination with braking. It is uncertain as to the validity of this issue, but deceleration combined with braking was consistently rated higher than braking by itself. The notion here is essentially one of moderating braking force or ceasing to brake to obtain better steering control, during a portion of the avoidance maneuver. The remaining maneuvers that were better than the group mean continue in the same general trend as above. Steering appears imperative, and generally should be to the right. Speed reduction was present in 15 of these 16 above average maneuvers; the remaining one involved acceleration. What not to do is explicitly indicated. A driver should not continue as he/she was when he/she perceived the emergency, should not accelerate straight ahead, and should not steer straight while trying to reduce vehicle speed. One possible explanation for the presence of maneuvers 1.1 and 1.3 in the worst group is that steering straight and braking was the most often tried maneuver by drivers in this study, each of which by definition ended in failure (only accidents were examined).

EXAMINATION OF ENVIRONMENTAL CONDUCIVENESS: The primary purpose of the environmental analysis was to calculate a set of maneuver probabilities with the added control of environmental conduciveness employed, and these results are presented in Appendix K of Reference 2. These results provide the maneuver probabilities conditional upon the driver's situation, perception of danger, and upon the environment's conduciveness. These tables thus indicate the average probability of success of each maneuver in a given situation, given (1) that the driver perceived danger in time to take evasive action, and (2) that the environment was "conducive" to avoidance.

In rating the probability of success of each maneuver for a given driver, raters were required to indicate (yes or no) whether the environment (e.g., trees, parked cars, other traffic) was "conducive" to each maneuver. The data developed indicates the percentage of cases for which an environmental hindrance was associated with each maneuver. Maneuver 8.4 was the maneuver most often environmentally constrained. As would be expected, steering maneuvers are consistently more subject to environmental constraints than are maneuvers which employ straight steering.

TABLE 2.9: BEST MANEUVERS FOR HIGH FREQUENCY SITUATIONS

MOST FREQUENT SITUATION	SITUATION MEAN[1]	HIGHEST PROBABLE MANEUVERS	GRO
3.1	.203	2.1, 2.3, 3.1, 3.3, 4.1, 6.1, 6.3, 7.1, 7.3, 9.3	.2
3.2	.186	2.1, 2.3, 3.1, 3.3, 6.1, 6.3, 7.1, 7.3, 8.3, 8.4	.2
3.4	.108	0.4, 2.3, 6.0, 6.4, 7.1, 7.3, 8.4, 9.1, 9.3, 10.4	.1
3.5	.123	0.4, 2.3, 3.1, 3.3, 6.0, 6.4, 7.3, 10.4	.1
3.6	.222	2.1, 2.2, 2.3, 3.3, 6.0, 6.1, 6.2, 6.3, 7.1, 7.3	.4
3.7	.287	2.3, 3.1, 3.3, 6.0, 6.1, 6.2, 6.3, 6.4, 7.1, 7.3	.4
3.8	.297	2.1, 2.3, 3.1, 3.3, 6.1, 6.2, 6.3, 7.1, 7.3	.3
3.9	.166	0.4, 2.5, 3.3, 4.5, 6.4, 8.4	.1
3.0	.217	2.3, 3.3, 6.3, 7.1, 7.3	.3
		2.1, 2.2, 3.1, 5.3, 6.0, 6.1, 6.2, 6.4, 8.3, 9.1, 9.3	.2

---

[1] Data is taken from the set of probabilities in which the control for driver perception was

BLE 2.9: BEST MANEUVERS FOR HIGH FREQUENCY SITUATIONS

HIGHEST PROBABLE MANEUVERS	GROUP RANGE
2.1, 2.3, 3.1, 3.3, 4.1, 6.1, 6.3, 7.1, 7.3, 9.3	.251-.306
2.1, 2.3, 3.1, 3.3, 6.1, 6.3, 7.1, 7.3, 8.3, 8.4	.213-.263
0.4, 2.3, 6.0, 6.4, 7.1, 7.3, 8.4, 9.1, 9.3, 10.4	.128-.228
0.4, 2.3, 3.1, 3.3, 6.0, 6.4, 7.3, 10.4	.175-.275
2.1, 2.2, 2.3, 3.3, 6.0, 6.1, 6.2, 6.3, 7.1, 7.3	.412-.531
2.3, 3.1, 3.3, 6.0, 6.1, 6.2, 6.3, 6.4, 7.1, 7.3	.404-.552
2.1, 2.3, 3.1, 3.3, 6.1, 6.2, 6.3, 7.1, 7.3	.380-.474
0.4, 2.5, 3.3, 4.5, 6.4, 8.4	.166-.691
2.3, 3.3, 6.3, 7.1, 7.3	.303-.336
2.1, 2.2, 3.1, 5.3, 6.0, 6.1, 6.2, 6.4, 8.3, 9.1, 9.3	.217-.293

e set of probabilities in which the control for driver perception was in effect.

TABLE 2.10 WORST MANEUVERS FOR HIGH FREQUENCY SITUATIONS

MOST FREQUENT SITUATION	SITUATION MEAN[1]	LOWEST PROBABLE MANEUVERS
3.1	.203	0.0, 0.4, 1.1, 1.3, 8.4, 10.4
3.2	.186	0.0, 0.4, 1.1, 1.3, 10.4
3.4	.108	0.0, 4.1, 4.2, 4.3, 4.5, 5.1, 5.3, 8.0
3.5	.123	0.0, 1.1, 1.3, 8.0, 8.1, 8.2, 8.3, 8.4, 9.1, 9.3
3.6	.222	0.4, 4.5, 8.0, 8.1, 8.2, 8.4, 9.1
3.7	.287	0.0, 0.4, 4.5, 8.0, 8.2, 8.4, 10.4
3.8	.297	0.0, 0.4, 1.1, 1.3, 10.4
3.9	.166	0.0, 1.1, 1.3, 2.1, 8.0, 10.4
3.0	.217	0.0, 0.4
		1.1, 1.3, 10.4

---

[1] Data is taken from the set of probabilities in which the control for driver perception wa

LE 2.10 WORST MANEUVERS FOR HIGH FREQUENCY SITUATIONS

LOWEST PROBABLE MANEUVERS	GROUP RANGE
0.0, 0.4, 1.1, 1.3, 8.4, 10.4	.010-.119
0.0, 0.4, 1.1, 1.3, 10.4	.027-.123
0.0, 4.1, 4.2, 4.3, 4.5, 5.1, 5.3, 8.0	.016-.068
0.0, 1.1, 1.3, 8.0, 8.1, 8.2, 8.3, 8.4, 9.1, 9.3	.050-.050
0.4, 4.5, 8.0, 8.1, 8.2, 8.4, 9.1	.019-.050
0.0, 0.4, 4.5, 8.0, 8.2, 8.4, 10.4	.111-.159
0.0, 0.4, 1.1, 1.3, 10.4	.008-.136
0.0, 1.1, 1.3, 2.1, 8.0, 10.4	.018-.091
0.0, 0.4	.034-.085
1.1, 1.3, 10.4	.109-.128

set of probabilities in which the control for driver perception was in effect.

If maneuvers 0.0 through 1.3 and 10.4 are excluded, any further distinctions are over-shadowed by the relatively small differences among steering maneuvers (range is 6.0 percent among steering maneuvers). In each maneuver, groups were compared. Each group is indicated by either: (1) its direction component, (2) direction of steer, (3) path selection, or (4) speed change. In the first comparison, the dimension of direction was analyzed--driver intent was suppressed. Steering left immediately was shown to be the most constrained, with delayed left steering a close second. Comparison two further indicated the difference between left and right steering. In comparison two, both driver intent and the immediateness of steering application are suppressed. Comparison three concerns the path selection level of the maneuver concept. In every case the intent to continue on past the object is constrained to a greater degree than the intent to stop at or before the object. In the final comparison, the change of speed option was investigated, with the surprising result that speed decreases were more constrained than were speed increases. Reasons for this are not clear.

It was found that maneuvers identified in the taxonomy were constrained to a significantly greater or lesser degree, depending on the situation. The combination of 31 maneuvers and 2 situational grouping schemes produced 62 tables, and all were significant at the .041 level or better. The vast majority were significant at the .005 level or lower.

HORN ANALYSIS: During the maneuver probability analysis, the raters were asked to assess the probability that the horn would help the driver if it were used in its best circumstance. The resultant "horn probabilities" are presented in the right-hand column of Table 2.8.

In further assessing the horn question, it was considered: what are those situations in which the horn was considered to be the greatest help? A variable entitled "degree of certainty" was coded for each event. The results of this analysis indicate that given that a driver is in an emergency traffic conflict situation and has time to attempt evasive action, use of the horn was indicated to be of "certain" benefit to 1.9% of drivers (5 of 265), and of "certain, probable, or possible" benefit to 32.5% (86 of 265). Attempts at trying to measure, for specific maneuvers, the increased probability of success contributed by the horn's use awaits further study.

SUMMARY ANALYSIS: The results of the summary analysis are presented in Figures 2-3 and 2-4, which are "by-driver" and "by accident", respectively. A

FIGURE 2-3 AVOIDANCE SUMMARY - BY DRIVERS

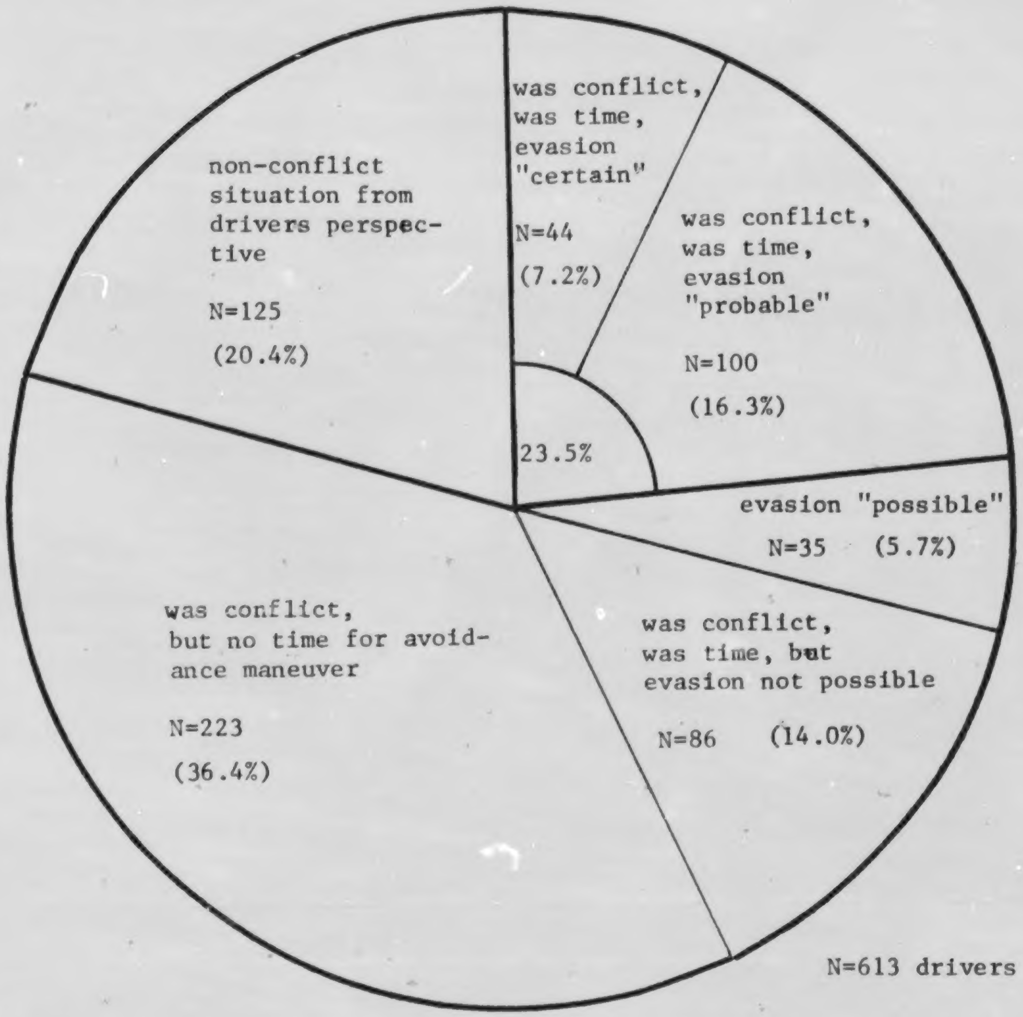
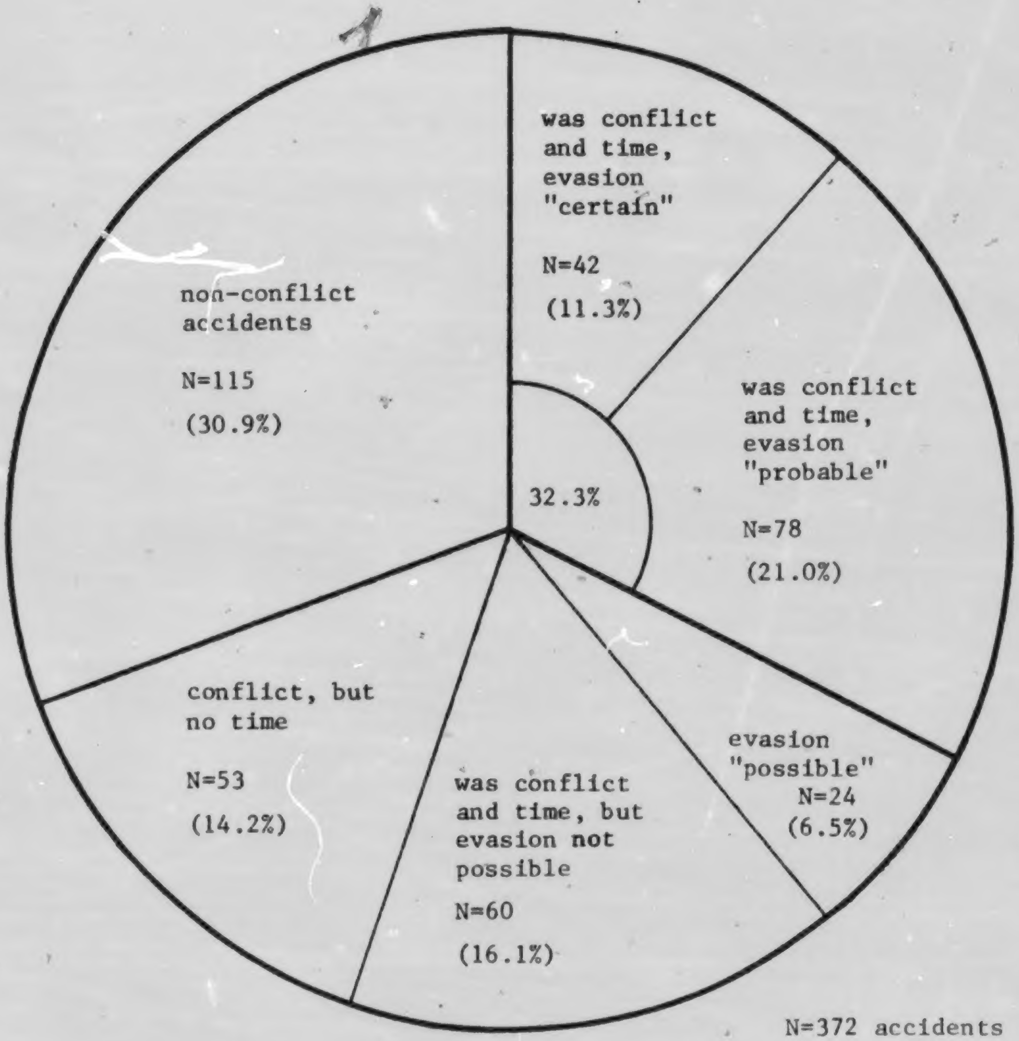


FIGURE 2-4: AVOIDANCE SUMMARY - BY ACCIDENTS



N=372 accidents

designation of "Certain" corresponds to a probability of evasion of .9 or higher; "Probable" corresponds to .7 or .8; "Possible" corresponds to an assuredness of .5 or .6.

Examination of Figure 2-3 shows that evasion of an accident was "certain" or "probable" for 29.5% (144/488) of drivers in conflict situations if all drivers who had time took the optimal avoidance maneuver. Figure 2-4 indicates that 46.7% (120 of 257) of the traffic accidents involving conflict situations considered in this study could "probably" have been evaded, if all drivers had selected the optimal maneuver for their situation. For proper interpretation of a statement such as this, a confidence level should be affixed. Applying a ninety-five percent confidence level to the chance of obtaining at least 120 successes (the placement of an accident in either the probable or certain category) in 257 trials (each accident is considered a trial) indicates (with 95 percent chance of success) that the percentage of accidents that can be evaded at the probable level of certainty falls between the limits of 40.6 and 52.8%. The probability of avoidance using the best maneuver varies significantly from situation to situation, however, and between the combinations of situations which describe conflict type accidents.

FAILURE ANALYSIS: Table 2.11 presents the marginal distribution for the maneuvers that the accident drivers actually attempted. The fact that stands out is that nearly 38 percent (100 of 265) of the accident drivers in conflict situations who have time to attempt evasive action, attempt maneuver 1.1 (steer straight only and brake with intent to stop before object. The proportions presented are the best estimates available from this project of any given maneuver's probability of being selected. The fact that only failures (i.e., accidents) are represented in this study requires that these proportions be viewed with caution.

Table 2.12 presents the marginal distribution for the "violations of performance assumptions" variable. This variable tallies how often drivers did things which it was postulated they should not do in executing avoidance maneuvers. For example, it was postulated that drivers should not lock up their wheels while braking, so that steering control could be maintained. Yet, Table 2.12 shows that 45% of the drivers attempting to evade a traffic conflict accident locked-up their vehicle's wheels sometime during their avoidance attempt. It was also determined that there is significant association between

TABLE 2.11 DISTRIBUTION OF ATTEMPTED MANEUVERS

MANEUVER ATTEMPTED		FREQUENCY	PERCENTAGE[1]	MANEUVER ATTEMPTED		FREQUENCY	PERCENTAGE[1]
0	0.0	105	-	18	5.3	0	0.0
1	0.0	117	-	19	6.0	7	2.6
2	0.0	12	4.5	20	6.1	21	7.9
3	0.0	5	1.9	21	6.2	6	2.3
4	0.4	11	4.2	22	6.3	0	0.0
5	1.1	101/100[2]	37.7	23	6.4	2	0.8
6	1.3	2	0.8	24	7.1	23	8.7
7	2.1	2	0.8	25	7.3	2	0.8
8	2.2	0	0.0	26	8.0	6	2.3
9	2.3	2	0.8	27	8.1	12	4.5
10	2.5	0	0.0	28	8.2	2	0.8
11	3.1	9	3.4	29	8.3	2	0.8
12	3.3	1	0.4	30	8.4	0	0.0
13	4.1	2	0.8	31	9.1	19	7.2
14	4.2	0	0.0	32	9.3	2	0.8
15	4.3	0	0.0	33	10.4	3	1.1
16	4.5	0	0.0	34	Other	10	3.8
				TOTAL		488	100.0

[1] Percentages are computed only for those drivers who had time to attempt evasive action.

[2] Only 100 drivers who perceived the danger in time attempted this maneuver.

TABLE 2.12 MARGINALS FOR PERFORMANCE VIOLATIONS

PERFORMANCE VIOLATIONS	FREQUENCY	PERCENTAGE
None	136	51.3
Locked Brakes	119	44.9
Overcompensated Steering	7	2.6
Both	0	0.0
Panic or Freezing	3	1.1

the maneuver actually attempted by the accident driver, and his probability of successful evasion (i.e., "degree of certainty") employing this maneuver. Further study is required in order to understand the reasons for this association.

2.2.4 Conclusion and Recommendations

CONCLUSIONS:

Based on an analysis of 372 case histories of accidents occurring in Monroe County, Indiana during the years 1970 through 1974, involving 613 drivers, the following findings and conclusions were reached:

1. Of the 372 accidents, 257 (69%) involved an emergency conflict situation for one or more of the involved drivers. Of the 613 drivers considered, 488 (80%) faced emergency conflict situations.
2. Of the 488 drivers who experienced emergency conflict situations (situation group 3.0), 265 (54%) were evaluated as having perceived the conflict in time to attempt an avoidance maneuver; the remaining 223 (46%) were evaluated as not having perceived the conflict in time to attempt an avoidance maneuver. Of these 223 drivers who did not have time, 105 (47%) were not aware of an impending collision until it had actually occurred. These 105 drivers having no awareness of an impending collision until after impact consituted 17% of all accident-involved drivers in the study sample.
3. In approximately one out of every 5 emergency conflict accidents (53 of 257 or 21%), none of the drivers involved in the accidents was evaluated as having perceived the conflict in time to attempt evasive action.
4. In the accidents studied, 257 of which involved emergency traffic conflict situations, if each driver in a conflict situation chose his optimal avoidance maneuver, avoidance was at least "possible" (i.e., probability was .5 or better) in 144 accidents (56% of conflict accidents or 39% of all accidents considered). Similarly, evasion was "probable" (probability .7 or better) in 120 accidents (47% of conflicts, 32% of total), and "certain" (Probability .9 or better) in 42 accidents (16% of conflicts, 11% of total accidents considered).
5. Of the 17 top-level situation categories, the one most frequently cited was: "Driver, while traveling into an intersection (path or roadway), suddenly perceives another vehicle crossing in front of his/her path." This accounted for 80 of 488 traffic conflict drivers (16%).

6. When confronted with an emergency traffic conflict situation, a driver must take action (the "null" maneuver of essentially taking no action was consistently evaluated as having a low probability of success). Steering straight while braking was also relatively unsuccessful across most situations. Typically, the maneuvers having the highest averages across all situations require steering (generally to the right) and speed reduction.
7. For drivers classified as falling within the same traffic conflict situation, the probability of avoidance given a particular maneuver varied widely from accident-to-accident. Environmental constraints may account for some of this variance.
8. The average probability of avoidance using the optimal maneuver for each situation varies significantly from situation to situation.
9. The environment is an important constraint upon a given maneuver's probability of success for a given accident situation. Maneuvers involving a steering input to the left or right are more frequently hindered than maneuvers involving straight steering. Maneuvers involving a left steering input are more frequently hindered than those involving a right steering input.
10. Sounding the horn was found to be of at least possible benefit to 86 of the traffic conflict situation drivers (32% of those who had time to attempt evasive action, 18% of all traffic conflict drivers).
11. It was found that 45% of accident drivers involved in emergency conflict type accidents who attempted an avoidance maneuver, locked their vehicle's wheels sometime during their avoidance attempt.

RECOMMENDATIONS:

1. Further development and refinement of the concept of a maneuver and the maneuver taxonomy is desirable. Within the scope of the present project, it was necessary to define a limited set of maneuvers which could be applied across all situations. In future efforts, maneuver categories could be further subdivided and the taxonomy developed in greater detail. It might be feasible to integrate a task analysis with the maneuver taxonomy concept.
2. It has been noted that within the same situation, the probability of avoidance may vary considerably from accident to accident, even for the same maneuver. In part, this may indicate the need for further development of the situation taxonomy, particularly for intersection accidents.

3. Cluster analysis or other analytical techniques could be utilized in an attempt to associate unique combinations of variable values with the accident situations.
4. Further effort is needed in the analysis of driver failures: The distribution of attempted maneuvers presented in this study is of limited utility, since only drivers who failed (i.e., were involved in accidents) have been considered. Ideally, a method should be developed to establish how frequently drivers in emergency conflicts actually attempt the various maneuvers, given the accident situations defined. A "near miss" analysis might be considered. Based on this, a comparison should be made between what drivers actually attempt and the maneuvers assessed as being most likely to succeed in the same situation.
5. Consideration should be given to incorporating the assessement procedures developed in this project, or similar assessment procedures, within a field accident study program. A difficulty experienced in the present effort is that the maneuver success raters had limited knowledge regarding environmental constraints, which in turn were highly determinative of maneuver success. Although IRPS accident reports are highly detailed and report most environmental constraints, there is no doubt but what more accurate assessments would have been possible given personal familiarity with the accident and the accident scene. This could be best obtained by incorporating the assessment process on an on-going basis into a research program where investigators respond directly to accident scenes at the time of their occurrence. Placement of parked cars and other transient hazards may be especially critical. As a part of this, it might be possible to develop an environmental conduciveness index, which would facilitate extrapolation to other environments. Variables considered in the development of such an index might include grade, coefficient of friction, road surface condition, super-elevation, cross slope/crown, vehicle presence in adjacent or opposing lane, presence of stationary objects, presence of shoulder, and presence of view obstructions.
6. The need for programs to increase driver attention and awareness are indicated. Overall, 46% of drivers in the traffic conflict situations were evaluated as not having perceived the conflict in time to attempt evasive action. Of these, almost half (47%) remained unaware of the impending

collision until it had occurred. Those totally unaware amounted to 21.5% of all drivers in the emergency conflict situations studied. This included 31.4% of traffic conflict drivers involved in intersection accidents, 6.7% of those struck head-on, 42.8% of those rear-ended, 14.3% of those struck on an oblique or acute angle (adjacent), and 4.8% of those involved in other configurations.

7. Given the possibility that 56% of traffic conflict accidents might be avoided by selection of the optimal avoidance maneuver, efforts to develop and evaluate a training program aimed at enabling drivers to select and successfully execute such maneuvers appears highly desirable.

2.3 TASK AND BEHAVIORAL ANALYSES

This section is a condensation of the Final Report of a study entitled "Collision Avoidance Training: Analysis of Requirements Imposed Upon Drivers by Collision Avoidance Situations"(3). This study was performed by the National Public Services Research Institute (NPSRI) of Central Missouri State University, under contract to the URS/Matrix Company.

The NPSRI effort involved the analysis and description of conflict situations, and identification of the perceptual , response selection, and motor response requirements of various types of collision situations. In addition, a series of collision avoidance pilot experiments was conducted jointly by NPSRI and URS/Matrix, and described in section 2.4 of this report.

2.3.1 Objectives

The primary objective of the NPSRI study reported herein was to attempt to identify the types of skills that are required for avoidance of collision, as part of the overall program effort to determine whether it is possible and feasible to develop and administer the training needed to endow drivers with the collision avoidance skills. A collision avoidance situation, for purposes of this study, was defined as shown in Section 1.0 of this report (See footnote *"critical conflict", page 1). This definition requires some explanation. First, the restriction of collision situations to inter-vehicle conflicts excludes potential collisions with fixed objects, a practical rather than theoretical exclusion. The majority of potential collisions with fixed objects occur off-road and require only a return to the roadway. While the manipulative skills involved in a quick return to the roadway are complex, they appear to be subsumed within the range of manipulative skills that are involved in inter-vehicle conflicts.

The requirement that there be a response which will avoid or ameliorate a collision is intended to exclude those cases in which the collision is so imminent that no successful response is possible. Finally, the requirement that collision avoidance or amelioration involve time compression--and therefore accelerated perceptual, response selection, and manipulative responses--is intended to distinguish the skills involved in collision avoidance from those that characterize normal driving. Unfortunately, situations vary too much among one another to be accurately characterized in terms of actual time intervals (although most involve intervals of less than 3 seconds), hence the need to define them in terms of the skill requirements they create.

2.3.2 Analysis of Conflict Situations:

Conflict situations were studied by a combination of formal analytic and empirical methods. Both methods are discussed.

FORMAL ANALYSIS: The formal analysis began with a study of the Driver Education Task Analysis(9) to identify potential points of inter-vehicle conflict. Each situation was then further analyzed to determine the perceptual, response selection, and motor skill requirement imposed upon the driver. The original list of inter-vehicle conflict situations was reduced, by combining those situations having similar behavioral requirements, to the following five basic conflict situations:

- Lead Vehicle - Conflict resulting from rapid closure with a vehicle or obstacle ahead.
- Following Vehicle - Conflict resulting from the rapid overtaking of a following vehicle.
- Intersecting Vehicle - Conflict resulting from the approach of two vehicles on an intersecting, i.e., right angle, course.

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[9] McKnight, A. James, et al. Driver Education Task Analysis, Volumes I-IV, Human Resources Research Organization, Alexandria, Virginia, 1970.

- Converging Vehicle - Conflict resulting from the convergence of two adjacent vehicles.
- Oncoming Vehicle - Conflict resulting from the approach of two vehicles on a (head-on) collision course.

Each of the above conflict situations includes those created by the driver, from whose viewpoint the conflict is analyzed, and those created by the driver of another vehicle. Each of the five conflict situations was then analyzed in further detail, covering such behaviors as those involving continued assessment of the action of a conflict vehicle, secondary conflicts produced by activity of the conflict vehicle, secondary conflicts produced by an evasive maneuver itself, and reducing the severity of an unavoidable collision. This analysis resulted in the identification of between 15 and 30 specific behaviors for each conflict situation. All behaviors were plotted against a common time line to obtain a rough determination as to the feasibility of performing all of the behaviors that had been identified within the time that would be available. Estimates of the time to complete each behavior incorporated known or estimated reaction, decision, and performance times.

The results of the preliminary time line analysis indicated that the number of behaviors that had been listed for each conflict situation greatly exceeded those that could be performed by even a highly trained driver. Therefore, the number of behaviors was reduced by selecting only those responses which would be most successful, eliminating situations which have low probability of occurrence, and eliminating behavioral sequences that a driver is not likely to be able to perform.

EMPIRICAL DATA: To help overcome the deficiences of formal analysis, an empirical analysis of conflict situations was carried out. This analysis involved taking five-second time samples of the traffic environment surrounding drivers in "normal" city, suburban, rural, and freeway settings. Naturally, the number of time samples that could be expected to furnish real conflicts would be extremely small. However, many of the samples could be expected to include vehicles that represent potential conflicts, and the prevailing conditions which should be similar to those of actual conflicts. To obtain the time samples, a Super-8 camera was mounted behind the backseat of an automobile so as to capture a 35° view of the road ahead, and mirrors were mounted to obtain an approximately 90° view of the area behind the car. A single frame of film was exposed every five seconds over a period of one and a half hours as the car was driven through a variety of highway settings. Each time sample was preceded by a "presample" one-half second earlier, in order to obtain a wider view of the situation which constituted the sample itself, and allow moving vehicles and pedestrians to be distinguished from those that are stationary.

A total of 1,000 pairs of sample/presample frames were analyzed. All vehicles capable of producing a possible conflict with the camera car were identified. Many samples provided more than one conflict. Potential conflicts were considered only where development to an actual conflict was plausible. For example, Oncoming Vehicle conflicts were only considered in situations where the oncoming driver might attempt to, or be forced to, enter the driver's lane. A purely spontaneous move was not considered. A tally was then made of those alternatives specifically identified in the formal analysis (e.g., is a lateral move acceptable?).

The results of the analysis of potential conflict situations were integrated into the description of conflict situations. The speculative nature of this process has to be acknowledged. The greatest shortcoming was the inability to determine whether or not there was a vehicle directly alongside the car, the camera being blind to this area.

In addition to filming potential conflicts, data from accident investigations was reviewed. Most conflict situations are handled successfully and both parties escape harm. No one ever hears about these conflicts. Those conflicts that are not successfully handled result in accidents, some of which are subject to intensive investigation capable of furnishing considerable information about conditions surrounding the original conflict. At the time of this study, Indiana University had reanalyzed 58 of the 257 in-depth accidents in their files meeting the definition of conflict situations as given in the introduction. The data available concerning these accidents could be used to identify available evasive opportunities, whether or not the drivers took advantage of them.

2.3.3 Description of Conflict Situations

The behaviors involved in each conflict situation were depicted diagrammatically, followed by a narrative description of the behaviors involved. To illustrate the method used to describe conflict situations, the following pages include the description of the "Intersecting Vehicle" conflict. The remaining conflict situations (Lead Vehicle; Following Vehicle; Converging Vehicle; Oncoming Vehicle) are fully described in Reference 3, with inclusion herein limited to definition of the situation and presentation of the conflict situation diagram.

Behaviors that involve alternative sets of responses appear on the diagrams as diamond-shpaed blocks. Behaviors that lead to only one set of subsequent behaviors appear as rectangles. The "choice" behaviors are worded so as to call for a "yes" or "no" ra[illegible] than multiple sets of alternatives. This simply follows a convention in [illegible]ling with such behaviors and is not intended to imply a psychological process o[illegible] acceptance or rejection. The narrative provided for each diagrammed behavior discusses behaviors in the following three categories:

1. Perception - The perceptual skills required in determining the nature of conflict situations and collision avoidance or amelioration opportunities.
2. Response Selection - The skills required in selecting among alternative responses having differential probability of successful avoidance or amelioration.
3. Motor Response - The skills involved in carrying out motor responses required in determining alternative maneuvers and carrying out those that are selected.

The term "response selection" has been used instead of a more common term "decision making" to avoid some of the connotations of the latter term. Decision making tends to imply a conscious, rational process of weighing alternatives to arrive at a best course of action. Some collision avoidance situations may allow time enough for limited deliberation; most will require an immediate response. However, the term "response selection", since it designates an objective process of response selection without assuming any particular psychological process, is a more useful term.

The following conventions are employed in narratives:

1. The term "car" applies to the vehicle operated by the individual whose behavior is being described.
2. The term "vehicle" refers to other parties to the conflict, including other cars, bicycles, or even pedestrians.

3. The vehicle which produces the conflict is capitalized (e.g., Following Vehicle (FV)). Other vehicles that might be involved in the situation are identified by lower case letters.

INTERSECTING VEHICLE (IV): An Intersecting Vehicle (IV) conflict situation is one in which a vehicle is approaching from approximately a right angle at a speed which, if unchanged, will result in a collision with the car. The most common Intersecting Vehicle conflicts include:

1. Cars crossing at intersections.
2. Cars pulling out from cross streets, driveways, parking stalls.
3. Pedestrians or cyclists entering the street.

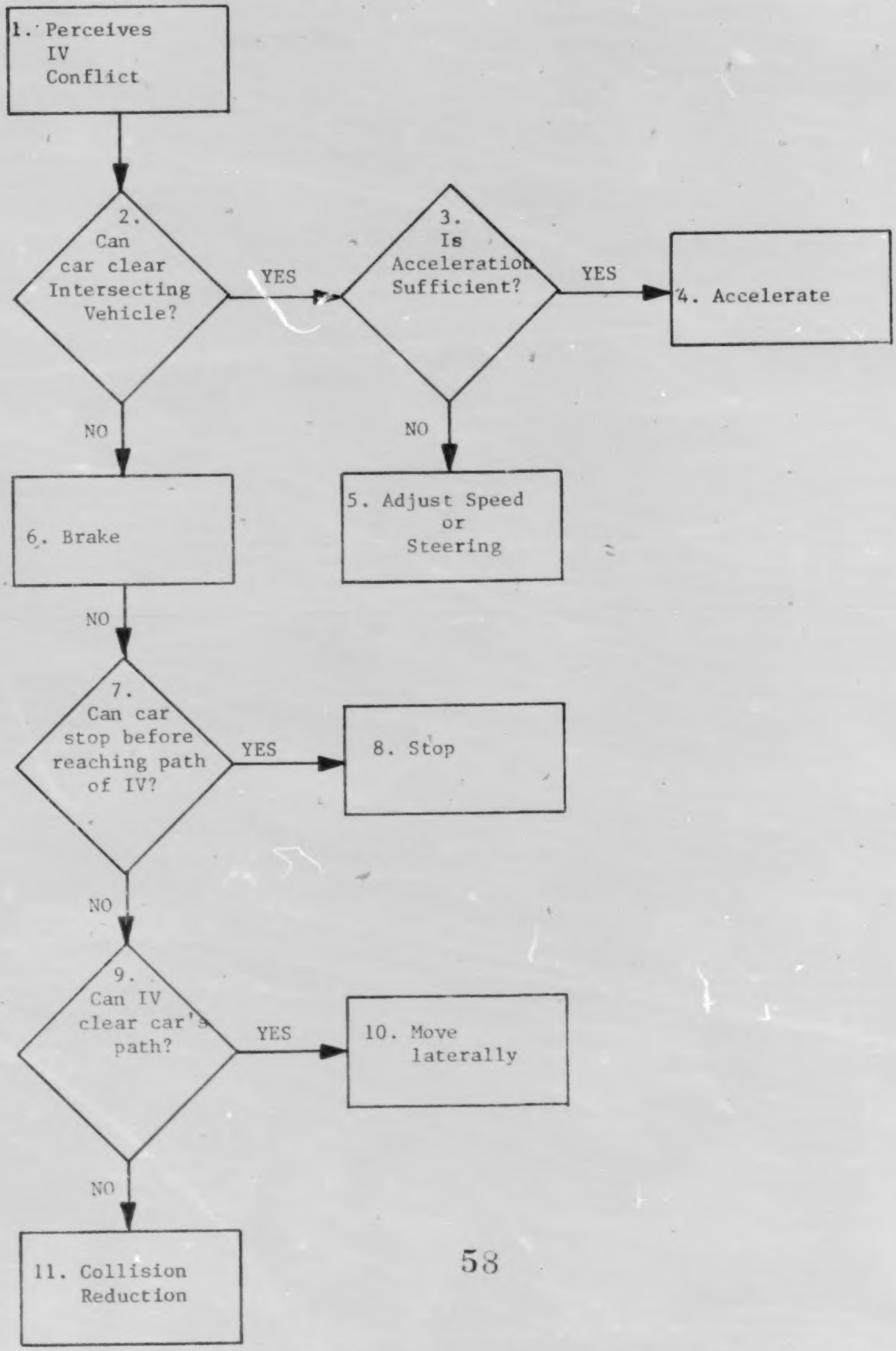
The Intersecting Vehicle response selection diagram appears in Figure 2-5; full narrative description follows.

(1) PERCEIVES CONFLICT. The perception of a conflict with an Intersecting Vehicle involves the magnitude and rate of change in the driver's viewing angle, defined as the angle between the path of the car--which represents the driver's presumed line of vision--and the position of the Intersecting Vehicle when it is first detected by the driver. If the angle is large (>45°) or increasing rapidly, the driver perceives that he will cross the IV's path. If it is small (<45°) or decreasing rapidly, the driver perveives the IV will cross his path. If it is approximately 45° and remains relatively constant, the driver perceives a conflict to exist.

Other perceptual factors that appear to influence the accuracy of IV conflict judgments are (1) closure with the IV, as perceived through changes in the visual angle subtended by the IV, and (2) distance to the point of intercept, as perceived through the size of the visual angle subtended by objects or surface areas at the point of intercept (if the car is far enough away from the point of intercept to be brought to a stop before reaching it, the conflict can be terminated regardless of the speed or distance of the IV). Of the 23 IV accidents analyzed, the driver of one or both vehicles perceived a conflict in only 11 cases.

In a situation that allows the driver to view the Intersecting Vehicle continuously, the judgment as to whether the car can clear the path of the IV will involve the perceptual cues described above. Research indicates that a perception that the IV can be cleared primarily involves changes in the

FIGURE 2-5: DRIVER BEHAVIOR IN INTERSECTING VEHICLE (IV) CONFLICT


1. Perceives IV Conflict
2. Can car clear Intersecting Vehicle?
YES
3. Is Acceleration Sufficient?
YES
4. Accelerate
NO
5. Adjust Speed or Steering
NO
6. Brake
NO
7. Can car stop before reaching path of IV?
YES
8. Stop
NO
9. Can IV clear car's path?
YES
10. Move laterally
NO
11. Collision Reduction

viewing angle of the IV and changes in closure. A judgment that the IV cannot, or should not, be cleared appear to involve cues of closure and distance to the point of intercept. The accuracy of conflict perceptions in a real world situation, with its attendant danger to life and limb, has not been determined. Also undetermined is whether or not the perceptions can be improved through training. Improvements may have to take place through simplifying the perceptions required rather than merely sharpening them.

For example, as might be expected, conflicts with slow moving Intersecting Vehicles tend to produce errors in the direction of perceiving that an IV can be cleared when it cannot or that the IV cannot be cleared when in actuality it can. This information itself might aid drivers in improving the accuracy of their judgments where the prevailing speed of IVs is known (from the nature of the highway upon which they are traveling).

It may be possible to derive decision rules from various situations that merely require the perception of distance (e.g., in the city, stop if you have not entered the intersection, continue if you have). Such simplifications will require additional data concerning situations in which various IV conflicts occur.

The selection of an accelerative versus braking response would be almost totally determined by the perceptions just described. The analysis of films of 16 potential IV conflict situations indicated that an accelerative response would be called for about a third of the time and decelerative response about two-thirds of the time.

Of the 23 IV conflict accidents analyzed one appears to have called for acceleration while six called for braking. The remaining 16 did not provide enough information to make a determination.

(2) CAN CAR CLEAR INTERSECTING VEHICLE? The first activity must be a determination as to whether the car can clear the path of the Intersecting Vehicle. If it can, the driver must respond with an immediate acceleration. Any delay will reduce the chances of avoiding a collision. This determination is one that few drivers in IV conflicts appear to make. So strong is a braking reaction to any conflict situation that brakes are usually applied before the driver becomes fully aware of the speeds and angles involved in the situation. Once the brakes are applied, it is almost always too late to correct the situation. Typically, one driver comes to a stop in the path of the other. This

treatment of IV conflicts assumes that the path ahead is clear enough to permit acceleration--that the car driver is not tailgating and that his egress from the intersection is not blocked. Consideration is not given to the simultaneous occurrence of both Intersecting Vehicle and Lead·Vehicle conflicts.

(3) IS ACCELERATION SUFFICIENT? If the driver can clear the IV, three alternative responses are possible:

- Maintain direction and accelerate across the IV's path.
- Maintain or reduce speed; move laterally away from IV.
- Some combination of the two.

If the IV were approaching at a moderate to high speed, acceleration would offer the best chance of collision avoidance. The effect of any lateral move would be negligible. For example, if the IV were approaching at 40-55 mph, a lateral move of as much as 6 feet would only allow an additional tenth of a second for the car to clear the vehicle. The potential benefit of a lateral move would be outweighed by its interference with the ability to accelerate. However if the IV were moving slowly--a car beginning to pull away from a stop sign--the increased seperation achieved by a lateral move might be enough to allow a collision to be avoided. Further, if the IV were an unprotected pedestrian or cyclist, a lateral move is far preferable from a viewpoint of injury reduction.

(4) ACCELERATE. When the path ahead is clear, the car should be accelerated as quickly as possible. If the car has an automatic shift, the accelerator should be depressed quickly to the floor to supply maximum power and to shift the transmission into low gear for maximum acceleration.

If the car has a manual transmission, it should be shifted as follows prior to pressing the accelerator: If in Neutral, shift to first; If in First, no change; If in Second, no change; If in Third, shift to second.

While the car is accelerating, the driver should determine whether the rate of closure with the Intersecting Vehicle is being, or will be, stabilized. In many, if not most instances, the driver will have to determine whether a collision will be avoided solely from this initial perception of closing rate and his perception of the car's acceleration.

(5) ADJUST SPEED OR STEERING. If simply accelerating is not sufficient or involves too great a risk, the driver must attempt to clear the path of the IV by steering around it. Use of the brakes should be avoided to reduce the

possibility of a skid and loss of steering control unless the vulnerability of the "vehicle" (cyclist or pedestrian) justified braking to minimize impact.

A lateral move would be accomplished by what is traditionally taught as an "evasive" maneuver. With the hands in a "9:00-3:00" position, the steering wheel would be rotated 180° in the desired direction, followed by a 360° countersteer in the opposite direction to return to the original line of travel and terminated with a 180° rotation to the "straight ahead" position.

The characteristics of specific conflict situations could necessitate additional responses including the following:

- Braking - An obstacle in the new path, such as a parked vehicle, might necessitate continued braking following completion of the turn and counterturn.
- Acceleration - A vehicle closing from behind in the same lane or an overtaking vehicle in the lane being entered might necessitate a quick acceleration to prevent the car from being struck in the rear.
- Skid Recovery - If the evasive maneuver takes place at high speed or on a loose or slippery surface (e.g., gravel shoulder), either the initial turn or the counterturn could result in a skid. The "normal" procedures for correcting a skid would be required including (1) oversteering in the direction of travel, (2) countersteering as the car approaches alignment with the path of travel in order to prevent "overshoot", (3) repeated countersteering as needed to correct residual overshooting (i.e., "fishtailing").

In addition to the control responses, the driver should make a quick check of the rearview mirror, and of the sideview mirror on a move to the left, to determine whether the car may be struck by an overtaking vehicle either in the lane being vacated or the one being entered.

(6) BRAKE. If it appears that the car cannot clear the path of the IV, the driver should brake as sharply as possible. This will frequently produce following vehicle conflict. However, the danger of being struck from behind and being pushed ahead is considerably less than that involved in being struck by an IV. Maximum speed reduction will be achieved by a "modulated" brake application, that is, one in which the brake is fully depressed to the point of locking the wheels, released slightly to allow the wheels to rotate, and then

re-applied, the process being repeated until the vehicle comes to a stop. The rate at which the brake should be applied will vary with the type of brake system. With a manual braking system, the process should take place about as rapidly as possible. However, where a power assist is supplied, the rate should be reduced somewhat (to about one per second) to allow for lag in the braking system.

(7) CAN CAR STOP BEFORE REACHING PATH OF IV? As the brake is being applied, the driver should determine whether the car will be able to stop before reaching the path of the vehicle. Whether or not the car can stop will be a function of (1) its distance to the intersection, (2) its rate of deceleration, and (3) whether it is being closed upon by a following vehicle.

Distance to the intersection would be perceived through the size of the visual angle being subtended by objects or surface markings at the intersection. Rate of deceleration would be perceived through changes in the rate at which distance cues are changing. How accurate the perception of a "change in a change" will be is not known. The driver may rely more upon his experience with the ability of the car to decelerate under various surface conditions than upon any direct perception of deceleration. The perception of closure with a following vehicle would involve the same cues as are described in discussion of following vehicle conflicts.

The analysis of potential IV conflicts indicated that the car could have stopped prior to reaching the IV in about a third of the cases. Of the six accident cases in which braking was called for proper braking would have appeared to allow the car to stop before reaching the path of the IV.

(8) STOP. If the car is slowing at a rate that would allow it to stop before reaching the intersection, the driver would continue braking until the car came to rest.

(9) CAN IV CLEAR CAR'S PATH? If the car itself is unable to stop (or if it would be struck by a following vehicle), the driver would have to determine whether or not the IV will clear the path of the car. If it will, or could, the driver should move laterally as much as possible (IV No. 10) to minimize the chances of a collision. If not, the driver should prepare to minimize the effects of a collision (IV No. 11). The determination is a critical one since an attempt to steer behind the IV places the two vehicles to some extent in opposition to one another, preventing the application of collision reduction measures.

Whether or not the IV will clear the car's path would be perceived primarily from the change in viewing angle of the IV relative to the car, as described earlier (IV No. 2 above). At this point the angle of the IV to the car should be such that the angle would have to be changing rapidly--the IV would be moving rapidly across the driver's view--in order for the IV to clear the car's path.

The determination as to whether to attempt to steer behind the vehicle will depend upon the following:

- Continuation of the IV - If the IV does not reduce speed--a condition likely to prevail only when the driver of the IV does not see the car-- then braking by the car should allow the IV to clear the path of the car before the car reaches the point of intercept.
- Gap in traffic - There must be an opening behind the IV through which the car can pass. If the conflict was produced by the driver of the IV, there is no reason to expect any other vehicle to be entering the intersection. Even if the conflict were produced by the driver of the car, the area immediately behind the IV should be clear. However, on multilane roadways, the gap is frequently filled by other IVs in adjacent lanes.
- Availability of adjacent area - An evasive maneuver behind the IV may be necessary to permit the IV to clear the car's path. The presence of an adjacent vehicle would prevent this maneuver.

The only motor response would be a quick look to the side to see if the adjacent area is available for an evasive lateral move.

(10) MOVE LATERALLY. If the IV can clear the car's path, the driver will continue braking and either maintain direction or move laterally behind the car. Generally, if a lateral move is possible, the driver will take advantage of it in order to further reduce the chances of a collision. The braking and steering responses would be the same as those described in connection with steering adjustments (IV No. 5).

(11) COLLISION REDUCTION. If it is apparent a collision is going to take place, the following options face the driver:

- Maintain direction and strike the IV, or be struck by the IV, at a right angle.
- Attempt a right angle turn in the direction the IV is proceeding and strike the IV along the side.

The selection of an effective collision reduction response will require the driver's perception of (1) the likely point of contact along the IV, and (2) the presence of other vehicles in or near the intersection. Perception of the point of contact involves the same general cues as were described in connection with the perception of IV conflicts. The perception of surrounding traffic conditions involves no special cues.

An abrupt right angle turn in the direction the IV is proceeding, if it can be performed and if it will not produce an OV conflict with some vehicle approaching the intersection, will reduce the magnitude of a collision with the IV by causing the impact to occur along the sides of both vehicles. Also, in a surprising number of conflict situations, it seems to result in avoiding a collision altogether. Accident investigations and anecdotal reports reveal many instances in which both vehicles proceeded on a parallel course without striking. It is difficult to understand how a car that could not stop before reaching the path of an IV could manage to complete a right angle turn. It seems likely that in many of these instances the driver could have braked to a stop but did not realize it. It is the question about the actual need for a right angle turn which has led to its omission as a possible evasive maneuver. If conditions will not permit a right angle turn, the driver will have no alternative but to proceed straight ahead.

A turn in the direction the IV is coming from does not appear to be desirable as it would add the velocities of the two vehicles and increase the magnitude of an impact. In some cases, an attempt to steer behind the IV as described earlier (IV No. 11) will not succeed and a collision will occur. However, unless the car driver has made an inordinately bad choice, the impact should occur well toward the rear of the IV where it would cause the IV to spin and reduce the magnitude of the impact. In any case, this is a far different matter than attempting to turn toward the IV in an actual collision situation.

The steering response required for a right angle turn with a minimum turning radius has not been established. A 180° steering input as described for an evasive maneuver (IV No. 5), maintained rather than being followed by a countersteer, would result in a sharp right angle turn. Whether the turning radius could be shortened by a larger steering input, say 360 degrees, would depend upon (1) how well the driver could carry out a larger steering change, and (2) the effectiveness of the steering input upon the motion of the car (would it cause the car to spin out rather than turn?). If the car is struck along the side by the IV, either at a right angle or along a parallel path, the driver must be prepared to make an immediate steering correction to avoid being deflected toward another vehicle or obstacle. Where the impact is great, the driver will not be able to maintain steering control unless well restrained. Unless an evasive steering maneuver were made, the driver would continue to apply a modulated brake up to the point of impact.

The appropriate driver position response will depend upon whether the car is striking the IV or being struck by it. If it is striking the IV, then if restrained by both a seat belt and a harness, the driver should brace his hands against the steering wheel to prevent being thrust against the steering column or having the head strike the windshield. Placing the head back against the head rest, or tensing the neck muscles if there is no head rest, will help prevent whiplash if the car is subsequently struck by a following vehicle. If the driver is only restrained by a seat belt, throwing the body horizontally across the front seat will prevent impact with the steering column or windshield and allow the back of the front seat to be used as a head rest. However, if the IV will strike the car, at either a right angle or on a parallel course, the driver must respond differently. A side impact will generally move the car laterally relative to the driver causing the driver to fall sideways across the seat. In anticipation of the impact, the driver must tighten his grip upon the wheel and flex his arm muscles in order to use the steering wheel as a means of maintaining body position and control of the car, enabling the driver to maintain the steering and braking needed to avoid being deflected into another vehicle or obstacle.

ONCOMING VEHICLE (OV): An Oncoming Vehicle (OV) conflict situation involves a conflict with a vehicle that is approaching the car from ahead (plus or minus approximately 45°) on a course that will result in an impact unless an appropriate evasive maneuver is performed quickly. The most common conflict situations appear to be the following:

1. Vehicle wandering, drifting, or weaving across center line.
2. Vehicle drifting across the center line on a curve.
3. Vehicle performing an unsafe passing maneuver.
4. Vehicle sliding across the center line on a slippery surface.
5. Vehicle proceeding in the wrong direction on a one-way street or highway.
6. Vehicle from the left making a wide turn onto the highway.
7. Vehicle from the right turning too sharply onto the highway.
8. Vehicle being forced across the center line by a merging vehicle.
9. Vehicle completing an off-road recovery.
10. Vehicle turning left.

The Oncoming Vehicle driver behavior diagram is presented in Figure 2-6.

FOLLOWING VEHICLE (FV): A Following Vehicle (FV) conflict involves a car being overtaken rapidly by another vehicle. Common Following Vehicle conflicts include the following:

1. The car has stopped or slowed suddenly.
2. The car has pulled out in front of an overtaking vehicle.
3. A vehicle is overtaking rapidly due to driver inattention, slippery surface, inadequate visibility, etc.

The Following Vehicle driver behavior diagram is presented in Figure 2-7.

CONVERGING VEHICLE (CV): A Converging Vehicle (CV) conflict situation is one in which a car and an adjacent vehicle are converging upon one another at an angle of less than 45 degrees. Common examples of Converging Vehicle conflicts are the following:

1. An adjacent vehicle attempting or being forced to change lanes.
2. Adjacent vehicle beginning a turn from the wrong lane (e.g., right turn from the center lane).
3. Adjacent vehicle attempting to enter or re-enter the roadway ahead of the car (e.g., freeway entrace, leaving curb).
4. Adjacent vehicle attempting to return to lane too soon after passing.
5. A vehicle turning into the highway and swinging too wide.
6. A vehicle completing a U-turn.
7. Car being forced by roadway conditions to enter a lane occupied by an adjacent vehicle (the conflict would have

FIGURE 2-6: DRIVER BEHAVIOR IN ONCOMING VEHICLE (OV) CONFLICTS

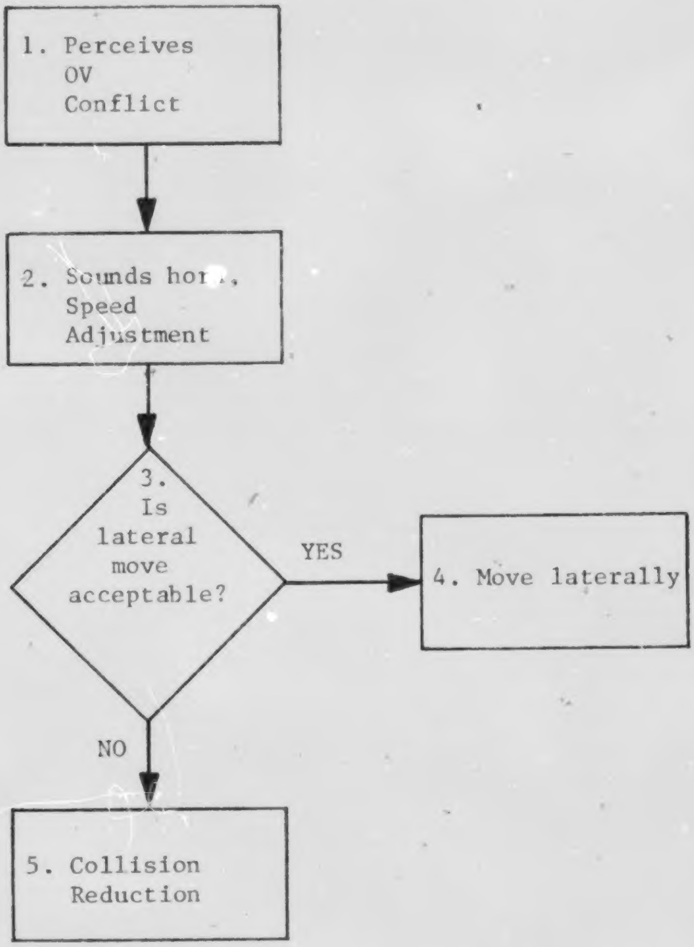
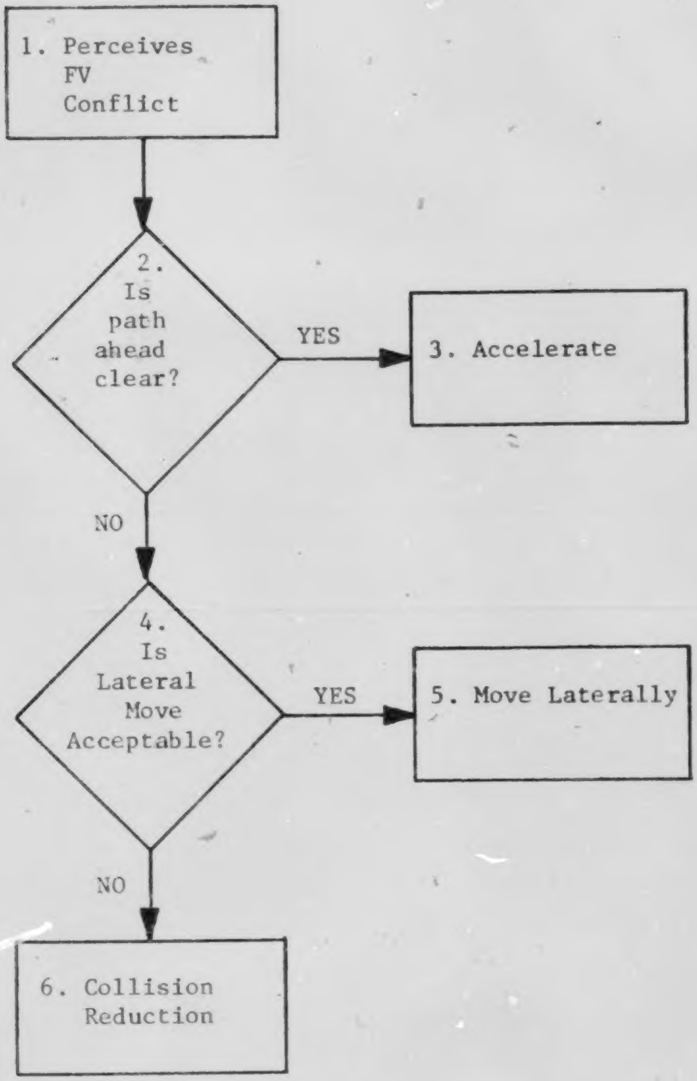

1. Perceives OV Conflict
2. Sounds horn, Speed Adjustment
3. Is lateral move acceptable?
YES
4. Move laterally
NO
5. Collision Reduction

FIGURE 2-7: DRIVER BEHAVIOR IN FOLLOWING VEHICLE (FV) CONFLICTS


1. Perceives FV Conflict
2. Is path ahead clear?
YES
3. Accelerate
NO
4. Is Lateral Move Acceptable?
YES
5. Move Laterally
NO
6. Collision Reduction

to be created by roadway conditions; if it were created by another vehicle, the primary conflict would be with the other vehicle, e.g., an oncoming vehicle during a passing maneuver).

Figure 2-8 presents the driver behavior diagram for Converging Vehicle conflicts.

LEAD VEHICLE (LV): A Lead Vehicle (LV) conflict situation involves rapid closure with a vehicle in the car's path headed the same direction as the car. The most common LV conflicts appear to be the following:

1. A vehicle ahead slows or stops suddenly.
2. A vehicle pulls out in front of the car from the curb or a side street.
3. An object falls from the vehicle ahead or the vehicle itself falls (i.e., a motorcycle).
4. The car is rapidly overtaking a vehicle ahead owing to inattention, slippery surface, inadequate visibility, etc.

The Lead Vehicle driver behavior diagram is presented in Figure 2-9.

2.3.4 Perceptual Skill Requirements for Collision Avoidance

JUDGMENT OF CLOSURE: The most pervasive perceptual requirement is that of judging closure with another vehicle or obstacle, including vehicles ahead, overtaking vehicles, and intersecting vehicles. Each of these judgments involves substantially different perceptual skills.

Judgment of closure with the vehicle or obstacle ahead falls into two categories, simple and compound. Judgment of simple closure is involved in determining whether a car can be brought to a stop before reaching a lead vehicle or a vehicle or obstacle in an adjacent lane. The judgment is frequently basic to the selection of collision avoidance or collision amelioration (i.e., collision reduction) responses. The constituents of this judgment appear to be Distance to vehicle (the visual angle subtended by the vehicle), Speed (the speed of the car as determined by: visual, auditory and kinesthetic cues), Rate of Closure, and knowledge of the Decelerative capability of the car (distance required to bring a car to a stop at a particular speed).

These four elements seem to combine to form a simple, unitary perception

FIGURE 2-8: DRIVER BEHAVIOR IN CONVERGING VEHICLE (CV) CONFLICTS

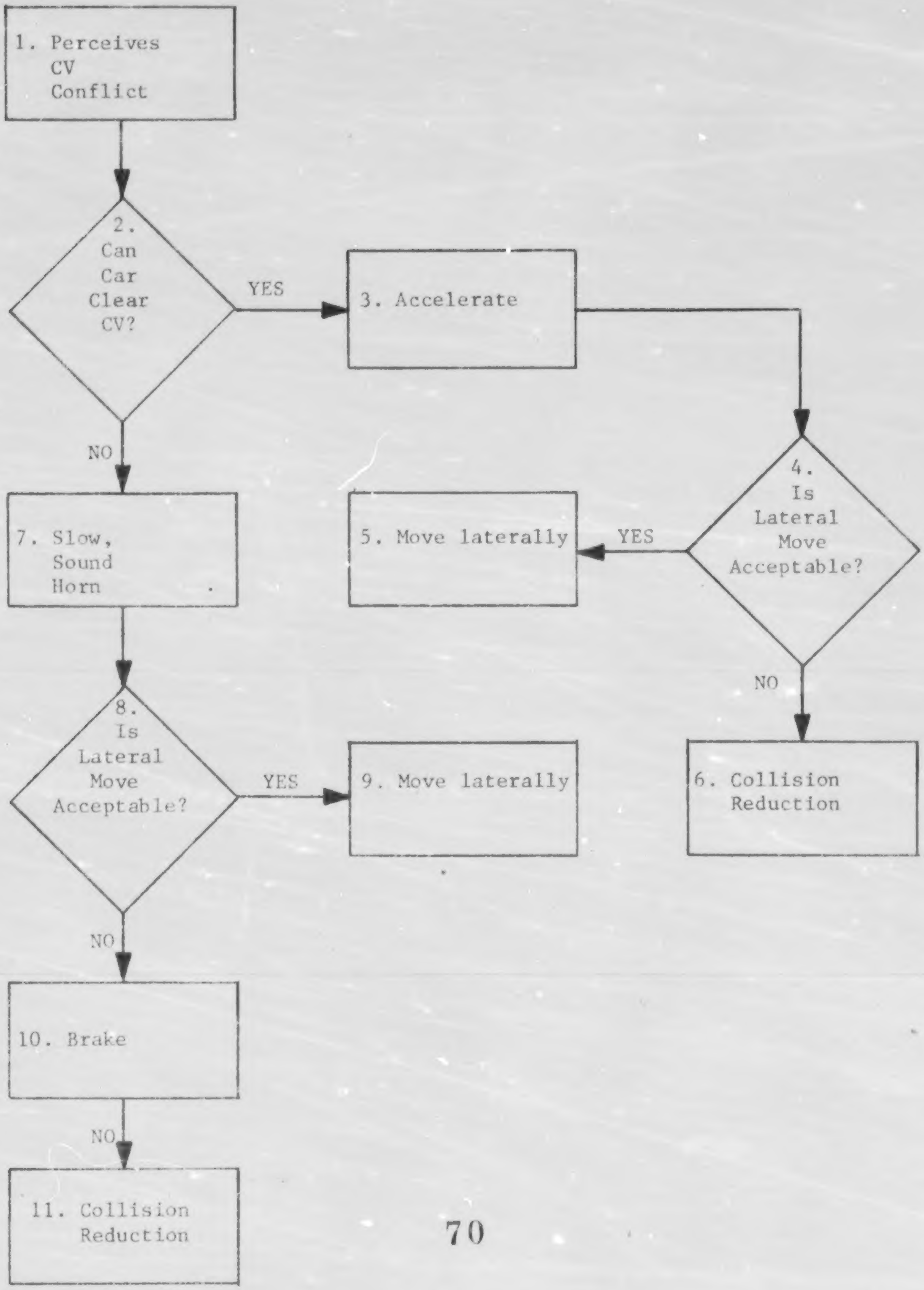
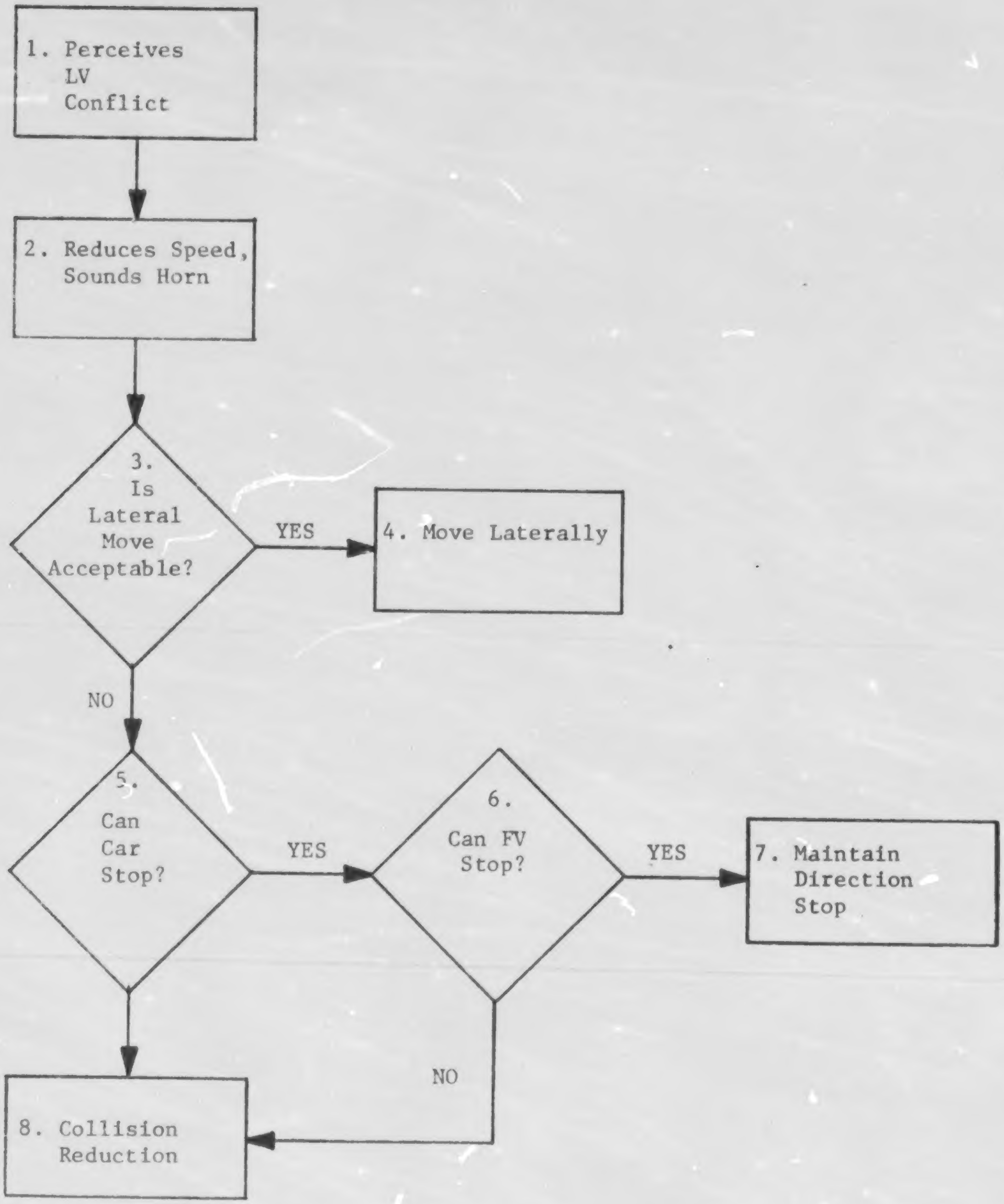

1. Perceives CV Conflict
2. Can Car Clear CV?
YES
3. Accelerate
NO
4. Is Lateral Move Acceptable?
YES
5. Move laterally
NO
6. Collision Reduction
7. Slow, Sound Horn
8. Is Lateral Move Acceptable?
YES
9. Move laterally
NO
10. Brake
NO
11. Collision Reduction

FIGURE 2-9: DRIVER BEHAVIOR IN LEAD VEHICLE (LV) CONFLICTS


1. Perceives LV Conflict
2. Reduces Speed, Sounds Horn
3. Is Lateral Move Acceptable?
YES
4. Move Laterally
NO
5. Can Car Stop?
YES
6. Can FV Stop?
YES
7. Maintain Direction Stop
NO
8. Collision Reduction

of the collision or non-collision situation. Since one element is dependent upon experience with the decelerative capability of an automobile, the nature of the perception may be expected to vary from individual to individual. The driver trained in proper braking technique would perceive a situation differently from one whose experience involved incorrect (i.e., locked wheel) braking, whose perception would, in turn, differ from that of an individual who had never attempted a sudden stop. However, the elements of the skill are such as to lead one to believe that the skill could be fairly readily acquired through training.

Some collision situations require a driver to make compound closure judgments, i.e., judge differential closure with two vehicles or obstacles, one in the path ahead and one in an adjacent lane. There are a variety of possible combinations - the vehicles in either lane could be stationary, approaching, or retreating. Judgment of differential closure of stationary and retreating vehicles is not a major concern since most situations will dictate following the course of the retreating vehicle. The most common cases appear to be the following:

1. Stationary (or slow moving) vehicle ahead; approaching vehicle in adjacent lane - The car approaches a stopped or slowly moving lead vehicle while an oncoming vehicle approaches in an adjacent lane. The driver must judge the differential closure of the two in order to determine whether it is possible to maneuver around the car before the oncoming vehicle arrives.
2. Approaching vehicle ahead; stationary vehicle in an adjacent lane - The car is approaching an oncoming vehicle while the adjacent lane is blocked by a stationary vehicle. The driver must judge the differential closure of the two in order to determine whether, if a lane change is made, the oncoming vehicle will pass and allow a return to lane before the stationary vehicle is reached.

Compound closure situations appear to impose a rather complex perceptual requirement upon the driver, particularly where one of the vehicles is oncoming. At the relatively long distances over which the closure of an oncoming vehicle must be perceived, the primary closure rate - rate of change in the visual angle subtended by the vehicle - is below the threshold of detection.(10)

Overtaking vehicles would include either Following Vehicles or overtaking vehicles in an adjacent lane. A determination as to whether or not a collision situation exists would involve the following:

1. Perception of distance and closure, involving the same cues as described in the case of vehicles ahead except that the cues are observed through the rearview mirror. A convex (i.e., parabolic) mirror would change the size/distance relationships and create a new skill requirement.
2. Decelerative capability of the Following Vehicle, that is, knowledge of how much distance may be required to stop the FV, and indications that it is attempting to stop.
3. Accelerative capability of the car, that is, the driver's knowledge, based upon experience, of his ability to accelerate ahead of an overtaking vehicle.

These elements appear to combine to form a single, unitary perception of a collision or non-collision situation.

While perception of a collision involving overtaking vehicles is similar to that involving collision with vehicles ahead, there are at least two basic differences. First, since the driver of the car approaching a vehicle ahead can assume no action on the part of the other driver, his determination as to whether a collision situation exists is based solely upon his determination as to whether his car can be stopped in time. However, in the case of a potential collision with an overtaking vehicle, there appear to be two processes involved: (1) will the overtaking vehicle stop in time, and (2) can the car be accelerated out of the path of the overtaking vehicle. Secondly, the perception of an overtaking vehicle generally occure over a shorter interval--quick glances at a rearview mirror--than does perception of closure with a vehicle ahead. For this reason, judgment of closure with an overtaking vehicle is likely to be somewhat less reliable until the vehicle is sufficiently close to produce fairly large changes in visual angle or a movement of the image across the retina.

In an intersecting vehicle conflict, the driver must decide immediately whether acceleration or braking offers the best chance of avoiding a collision. The selection of an appropriate response depends upon the driver's perception of closure with the intersecting vehicle. This perception is one of the most difficult to make and involves the following elements:

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(10) Farber, E., C. Silver, and D. Lambers, "Knowledge of Closing Rate vs. Knowledge of Oncoming Car Speed as Determiners of Driver's Passing Behavior," Highway Research Record, No. 247, 1968, pp. 1-6.

1. Viewing Angle - The angle of the car's path to the intersecting vehicle. A small (<45°) or rapidly diminishing angle indicates that the IV will cross ahead of the car. A large (>45°) or rapidly increasing angle indicates that the car will cross in front of the IV. A constant angle of approximately 45° indicates a collision course.
2. Distance - Including the distance of the car from both the intersection and the intersecting vehicle. Cues would be the angle subtended by the intersecting vehicle and objects or surface areas at the intersection.
3. Closure - Including rate of closure with the intersecting vehicle and the intersection. Cues would be the rate of change in the visual angle of the objects identified in (2) above.

The above elements combine to form an immediate perception of an "accelerative" or "decelerative" situation. Research(11) indicates that an accelerative response is based upon changes in viewing angle and rate of closure, while a decelerative response is based upon rate of closure and distance. The role of distance and closure cues in a decision to decelerate should be readily apparent. If the car can be brought to a stop before reaching the point of intercept between the two vehicles, a collision can be avoided no matter what the other vehicle does. A determination as to whether this is possible would be based primarily upon distance and closure cues, as described in the discussion of "vehicles ahead". Distance cues, on the other hand, would be irrelevant to a decision to accelerate, hence the primacy of viewing angle and closure rate.

JUDGMENT OF CLEARANCE: A small number of collision avoidance situations require the judgment of clearance, both lateral and longitudinal. Lateral clearance refers to the distance between the car and vehicles or obstacles to one or both sides. The selection of an avoidance maneuver calls for the judgment of lateral clearance before the car reaches the vehicles or obstacles in question; the driver must determine whether the car will fit between two objects, for example between a lead vehicle and a guardrail or between two trees.

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(11) Kidd, E.A. Urban Intersections Study, Volume 5, "Judgments of Velocity in Two Dimensions", Cornell Aeronautical Space, Incorporated, Buffalo, New York, September 1968.

The judgment of lateral clearance involves (1) a spatial judgment, as perceived through the visual angle subtended by the area between the objects that define the space, and (2) knowledge of the width of the car. These two elements combine to form a perception of sufficient or insufficient space. How accurately drivers can determine the adequacy of a space while some distance from it is not known. In normal operation, drivers will approach a tight space slowly, maneuver as close to the left edge as possible, and attempt to judge whether the right edge of the space extends beyond the right front fender of the car. Having to make a rapid determination of lateral clearance while some distance away is an unusual task for most drivers.

Longitudinal clearance refers to the distance between the car and the vehicle or object ahead. About the only time a judgment of longitudinal clearance is required is when the car is being closed upon by a Following Vehicle or while it is stopped close behind a vehicle ahead. A determination must be made as to whether there is enough room to turn without striking the lead vehicle. This determination would be based upon perception of distance to the lead vehicle and a knowledge of the car's turning radius. The necessary perceptual skills may be presumed to exist in the repertoire of most average drivers.

DIRECTION OF VEHICLE MOTION: There is some anecdotal evidence which suggests that perception of the direction another vehicle is moving, relative to the motion of the car, is a small but significant consideration in selecting responses to certain categories of conflict. Some cases have been found in which drivers, in an attempt to avoid an object in the path ahead, initiate an avoidance maneuver in the same lateral direction that the object is moving. Examples of laterally moving objects include (1) a box which has fallen from a vehicle ahead and is bounding toward the side of the road, (2) an oncoming vehicle out of control and drifting toward the right shoulder, or (3) a cyclist who has fallen and is sliding toward the side of the road.

The implication of this perceptual requirement upon collision avoidance training is uncertain. Perception of a vehicle's direction angle--the lateral movement of the image with respect to its background--is a skill that should be well established long before the age of driving. It may be that, if the rate of lateral movement is relatively small, a driver will tend to react before the movement is perceived. In any case, the ability to perceive angle of closure appears to be a significant consideration in avoidance of some collisions.

SURFACE CONDITION: The selection of an evasive maneuver will often require the driver to determine whether the surface of an adjacent roadway or roadside area will permit the car to be effectively controlled. To make this determination, the driver must be able to distinguish among the following general types of surfaces:

- Firm - A hard surface capable of both supporting the automobile and providing full traction, such as roadway lanes and paved shoulders.
- Loose - Surface conditions such as sand or gravel which offer limited traction.
- Slippery - Surface conditions such as water, mud, snow, and ice which offer very limited traction.
- Soft - Surfaces that will not support the weight of the car, such as deep sand, sod, muddy areas.

The perception of the adequacy of a surface area is based upon perception of surface texture, coloration, etc., and the driver's knowledge of the characteristics of the surfaces that are perceived. The average driver's knowledge of surface characteristics, at least as they relate to maneuverability of the automobile, is typically limited by lack of experience in operating on such surfaces. If there is a constant error, it seems to be in the direction of underestimating the ability of various surfaces to provide necessary control. This results in a reluctance to leave the roadway in situations where a roadside area offers an opportunity for a successful avoidance maneuver.

2.3.5 Response Selection Skill Requirements for Collision Avoidance

"Response selection", as defined in this report, involves the selection among alternatives having different, and less than perfect, probabilities of leading to avoidance of a collision. The more common response selection alternatives to safe drivers in collision avoidance situations are identified in the following paragraphs. Collision avoidance responses are not distinguished from collision reduction responses in this discussion because of the general need on the part of the driver to consider the two together.

BRAKING VERSUS MOVING LATERALLY (LV & FV CONFLICTS): One of the more common choices facing drivers is whether to attempt to stop before reaching a Lead Vehicle or to attempt a lateral move, in those situations where the success of either alternative is subject to some doubt. The primary considerations in the selection of a response would include the following:

- Closure with the lead vehicle
- Closure with a vehicle in an adjacent lane, both stationary (simple closure) and moving (compound closure)
- Closure with an overtaking vehicle in an adjacent lane
- Direction of lead vehicle motion
- Lateral clearance
- Surface condition

MOVING RIGHT VERSUS MOVING LEFT (LV, FV, OV CONFLICTS): A somewhat similar situation arises when the car cannot stop in time to avoid an obstacle ahead (Lead Vehicle or Oncoming Vehicle) and faces a choice between a lateral move to the right and one to the left. Considerations influencing this selection would be the same as those listed in the preceding paragraph with the exception of closure with the lead vehicle.

ACCELERATION OR BRAKING (IV, CV CONFLICTS): In a potential collision with an Intersecting Vehicle or a Converging Vehicle, the driver must accelerate or brake as quickly as possible. The selection of a response appears to be based entirely upon results of the perceptual process--the situation is directly perceived as an "accelerative" or "braking" situation--and does not involve a conscious selection between the two responses.

Errors in the case of Converging Vehicle situations appear to be infrequent since the perception involves simply the position of the Converging Vehicle with respect to the car. This is a simple perceptual process and easily handled by the average driver (and probably non-drivers as well). The Intersecting Vehicle situation imposes much more difficult perceptual requirements and is therefore much more likely to lead to operator errors. The dominant error is braking where acceleration is required. It would seem that the driver, being unable to determine what response is appropriate and having to respond immediately, falls back upon what is the most pervasive collision avoidance response. Some attribute the dominant use of braking to its being a "natural", that is, strongly learned, response to any collision situation. This explanation would appear to be refuted by the "natural" tendency of drivers to accelerate when being converged upon by a vehicle approaching the rear quarter of the car. The problem appears to lie not in the "naturalness" of the braking response but in the complexity of the perceptual requirement imposed by an IV conflict. It may be that when the appropriate response is not readily apparent that the driver reverts to a strongly learned response.

CHOICE OF BRAKING TECHNIQUES (LV, FV CONFLICTS): When squeezed between a vehicle ahead and one that is overtaking, in either a Lead Vehicle or Following Vehicle conflict, the driver must select that braking technique that will minimize the severity of a collision. (The situation, as defined, would not permit collision avoidance.) Possible braking responses can be ordered along two dimensions, timing (after impact; before and after impact; continuous), and application (light; hard; modulated). The situational considerations that govern the selection of alternative responses would appear to be (1) the distance of the car from the Lead Vehicle (far; median; close) and (2) rate of closure of the Following Vehicle (fast; medium; slow).

Theoretically, the driver is confronted by nine possible combinations of responses to nine possible combinations of situations. Doubtless the number of combinations would have to be reduced before any response selection rules could be generated. One can speculate with some security concerning extreme cases.

- If the distance to the lead vehicle is short and the rate of closure is fast, continuous hard application of the brake would seem the best way to avoid being accordioned between tha following vehicle and the lead vehicle.
- If, at the other extreme, the lead vehicle were distant and the following vehicle approaching very slowly, a light application after impact would seem to minimize damage.

In between these extremes, the situation-response associations seem less clear.

MOVE AWAY FROM OR TOWARD A CONVERGING VEHICLE (CV CONFLICT): When confronted with a converging vehicle conflict, the driver must choose between (1) turning away from the Converging Vehicle to reduce the likelihood of a collision with it, or (2) turning toward the converging vehicle to avoid being deflected toward an even greater hazard. Considerations involved in selecting between these alternatives include the following:

- Lateral clearance - the more room that is available between the Converging Vehicle and some adjacent hazard, the greater the chance there is of avoiding a collision with the Converging Vehicle, and therefore the more there is to be gained by a move away from it.
- Rate of convergence - the more slowly the Converging Vehicle is moving toward the car, the less chance there is of a collision and the less likely the car is to be deflected toward some adjacent hazard. Therefore, the slower the convergence, the more effective would be the move away from the Converging Vehicle.
- Nature of lateral restriction - the nature of the obstruction that restricts lateral movement, primarily whether it is a moving automobile or a fixed object (e.g., parked car) would influence the selection. An automobile moving in the same direction would favor a lateral move since (1) it could move laterally to accommodate the car, and (2) the impact would not be great. A lateral restriction imposed by a large fixed object or an Oncoming Vehicle would dictate a move toward the Converging Vehicle.

CHOICE AMONG COLLISIONS (LV, FV, CV, OV CONFLICTS): Where a collision is inevitable, the driver must select the collision which will minimize the risk of serious injury or death. This resonse option seems to be a "classic" in the sense that it is most often considered by textbooks dealing with collision avoidance--whether to strike a tree or bridge abutment, an oncoming car or telephone pole. While dramatic, this type of response option does not seem to arise often. First of all, it would appear that an adjacent lane is available for an evasive maneuver in between half and two-thirds of conflict situations. In the remaining cases, the choice appears to boil down to striking a car in the path ahead or turning into an adjacent vehicle.

Where the risk of a large impact with the vehicle ahead is great, i.e., an oncoming vehicle or lead vehicle stopped in a line of traffic, an attempt to force entry into an adjacent lane could be warranted. Otherwise, legal and moral considerations, in addition to those of overall safety, seem to dictate striking the vehicle in the car's path. Instances requiring a choice among off-road fixed objects or between off-road objects and a vehicle seem to be rare.

2.3.6 Motor Response Skill Requirements for Collision Avoidance

The motor responses required in carrying out collision avoidance or collision reduction responses fall into three categories: car control responses, vehicle oriented responses, and body position responses.

CAR CONTROL RESPONSES: Motor responses required for control of the vehicle include (1) evasive steering, (2) rapid braking, (3) rapid acceleration, (4) skid recovery, (5) impact recovery, and (6) 90° turns.

Evasive steering and rapid braking are probably the most thoroughly studied, taught, and practiced of vehicle control responses. Basic elements of the response are as follows:

1. A 9:00-3:00 hand position.
2. Steering consisting of:
   a. 180° steering wheel rotation away from the path of travel.
   b. 360° "countersteer" in the opposite direction to return to the original path of travel.
   c. 180° rotation to the "straight ahead" position to maintain the original path of travel.
3. Avoidance of hard braking to prevent locking the rear wheel and causing a skid.

"Modulated" braking will provide the most rapid speed reduction and allow directional control to be maintained. Modulated braking consists of depressing the brake fully to lock the wheels, releasing them briefly to allow them to rotate, repeating the process until the vehicle is slowed sufficiently or brought to a stop. The rate at which modulations occur depends on the type of brake system. With a purely hydraulic system, the process should take place as rapidly as possible. However where a power assist is supplied, the rate may have to be reduced somewhat (to about 1 per second) to allow for lag in the braking system.

Rapid Acceleration, if the car is an automatic shift, is accomplished by depressing the accelerator quickly to the floor to supply maximum power and shift the transmission into "passing" gear for maximum acceleration. If the car has a manual transmission, it should be shifted as follows, prior to depressing the accelerator:

Neutral - to first gear
First - no change
Second - no change
Third - to second gear

Skid Recovery. Rapid braking or acceleration, particularly during an evasive steering maneuver, may cause loss of directional control. The required responses consist of the following:

1. (Over)steering in the direction the car is actually moving (the direction it was headed before the skid occurred).
2. Countersteering as the car approaches alignment with the path of travel in order to prevent "overshoot".
3. Repeated countersteering as needed to correct residual overshooting or "fishtailing".
4. Release of the accelerator or brake.

Impact Recovery from a side impact, particularly toward the rear, will change the direction a vehicle is headed with the result that the car may strike another vehicle or obstacle. A quick steering correction is needed to maintain control. Being able to correct quickly enough seems to involve anticipation on the part of the driver of the direction and magnitude of the initial impact.

90° Turns. Some intersecting vehicle collisions have been avoided through abrupt 90° degree turns. This maneuver has not generally been a part of collision avoidance training and the best way of performing it is not widely known. However, it can be performed by an abrupt 180° steering wheel rotation that is maintained. Proper use of the brake can facilitate the maneuver by causing the rear of the car to spin.

VEHICLE ORIENTED RESPONSES: Responses directed toward other vehicles include observation and signals.

Responses required in observing other vehicles include mirror checks (movement of the eyes to view following vehicles in the rearview and sideview mirrors) and head checks (movement of the head to either side to observe vehicles immediately adjacent to the car).

These responses must occur quickly and simutaneously with the initiation of vehicle control responses. It does not appear that over-the-shoulder checks are feasible owing to (1) the time they take, and (2) their effect on vehicle control. A vehicle in the car's blindspot would have a reasonable chance of braking to avoid collision unless it were in the process of accelerating past the car , but such a compensatory maneuver cannot be assumed.

The only feasible *signal* to another driver would appear to be the horn. In a Converging Vehicle conflict, it may cause the other driver to return quickly to lane. In a Lead Vehicle conflict, it would enable the other driver to prepare for a collision and, in some cases, accelerate or turn out of the car's path. Use of the horn only seems feasible where it can be actuated by a horn ring, which allows the horn to be sounded quickly while both hands remain on the steering wheel.

BODY POSITION RESPONSES: Body position responses are those movements of the body designed to protect the driver from violent impact in the interior of the car at the occurrence of a collision. They can be conveniently grouped according to the nature of the collision: (1) front impact, (2) rear impact, (3) side impact.

Front Impact. Where the driver is totally restrained by seatbelt and harness, about all he can do to further protect himself is to cover his face with his arms to protect it from impact with the steering wheel or windshield or from flying glass. If restrained solely by a seatbelt, the driver may throw his body across the front seat to avoid impact with the steering wheel or windshield.

Rear Impact. Where completely restrained by seatbelt and harness, the driver should brace his neck against the head restraint (if one is available) or tense the neck muscles to avoid whiplash. If restrained only by a seatbelt, the driver may throw his body across the front seat to allow the back of the seat to be used as a head restraint.

Side Impact. Upon impact with the side, the driver should flex his arm muscles and tighten his grip upon the wheel in order to maintain a relatively upright body position and retain control of the car.

2.4 COLLISION AVOIDANCE EXPERIMENTS

This section describes a series of experiments conducted by NPSRI and URS/Matrix designed to determine the ability of drivers to acquire certain of the collision avoidance skills described in the preceding section.

2.4.1 Problem

The analysis of collision avoidance requirements identified a number of perceptual, response selection, and motor response skills required for successful collision avoidance. Braking and evasive steering, two of the motor response requirements, are elements of collision avoidance training as it has been extensively administered throughout the country over the past decade. The ability of drivers to acquire the skills involved in these activities has been amply demonstrated. However, the ability of drivers to acquire other of the collision avoidance skills described has not been so demonstrated. Before proceeding with the identification of collision avoidance training requirements, it appeared desirable to obtain some verification as to the ability of other skills to be acquired and applied.

2.4.2 Method

It was only possible to study a limited set of collision avoidance skills within the manpower resources and time available for experimentation. Two conflict situations were selected: Lead Vehicle, and Intersecting Vehicle conflicts. Within each of these conflict situations, a limited set of skills was selected for study. They include the following:

Skill	Lead Vehicle Conflicts	Intersecting Vehicle Conflicts
Perceptual	Perception of conflict: closure, distance, speed.	Perception of closure, viewing angle, distance.
Response Selection	Moving right versus moving left; braking versus moving laterally.	Acceleration versus braking.
Motor Response	Observations of traffic to the side and rear; steering and braking technique.	Braking technique.

SIMULATION OF COLLISION AVOIDANCE SITUATIONS: Owing to the danger inherent in real collision avoidance situations, it was necessary to resort to simulation in studying skill acquisition. Of the various types of simulation that are available, only that which involves use of motion picture films seemed economically feasible. Lead Vehicle and Intersecting Vehicle situations were filmed through the windshield of an automobile in staged conflict situations.

> Lead Vehicle Conflict - Two types of Lead Vehicle conflicts were filmed, (a) a Lead Vehicle suddenly stopping, and (b) a parked vehicle pulling into the path of the car either to continue in front of the car or to commence a U-turn.
>
> Intersecting Vehicle - In the Intersecting Vehicle situations, the car and an intersecting vehicle approached an intersection at the same time. As the car was approaching the intersection, the camera was panned so as to maintain a fixed reference point about 75 feet from the intersection in the direction of the IV. This meant that in all cases the IV would come into view at a point which was so close to the intersection the neither car could stop. Both acceleration and braking situations were simulated.

Films were exhibited to drivers in a specially devised apparatus consisting of (1) a driver's station possessing a steering wheel, brake, and accelerator,* (2) a rear projection screen upon which the filmed conflicts were exhibited to the driver, (3) two red lights positioned to either side of and slightly behind the driver's station to represent the presence (lights on) or absence (lights off) of adjacent vehicles, and (4) a blue light positioned behind the driver's station, visible through a rearview mirror which, when lit, represented a vehicle that was following too closely to be able to stop if the car braked.

A camera was positioned behind the driver's station to record driver responses, visual stimuli, and the lane occupancy signals. Each driver participated in four sets of trials: familiarization, pre-test, training, and post-test.

Familiarization. A series of trials was run to familiarize each subject with the controls of the simulator, the lights representing adjacent or following vehicles, and the film presentation. Footage not used in the test or training trial was projected to provide practice. Preliminary trials revealed that the films did not provide the perceptual cues needed to enable subjects to distinguish some characteristics of conflicts. The primary shortcoming appeared to be a lack of speed cues, i.e., the absence of noise and vibration, and a rather featureless visual stimulus.

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*The authors are indebted to Visual Educom, Inc., for loan of the driver station equipment.

Pre-Test. A pre-test film containing 10 conflict situations was prepared. The first four situations involved IV conflicts and the last six involved LV conflicts. Each of the 10 situations lasted approximately 10 seconds, with the actual conflict developing the last .5 to 1.5 seconds. When the conflict had fully developed, the film was stopped on a predetermined frame to prevent the subsequent film presentation, representing the response of the camera car, from interferring with the subject's response.

Training Phase. The training phase lasted from 60 minutes for the most proficient subject to 90 minutes for the least proficient. Each subject was given an explanation of the procedures to be used in dealing with each conflict situation. The procedures generally followed the diagram of Lead Vehicle and Intersecting Vehicle conflicts which appeared in the first section of this report. A practice film consisting of 11 Lead Vehicle and 5 Intersecting Vehicle conflicts was exhibited several times. The pattern of lights was changed for each exercise when the film was repeated. The training trials were not filmed by the rear-positioned camera.

Post-Test. A post-test was administered after completion of the training phase. The filmed conflicts of adjacent and following vehicle lights, and administrative procedures were identical to those used during the pre-test, to allow direct comparison to be made. However, in order to reduce the effects of recall, the order in which the conflict situations were presented was changed from pre-test to post-test.

Data Analysis. The filmed record of each pre-test and post-test trial was analyzed on a frame-by-frame basis. The frames during which the conflict occurred as well as the frames during which each of the subject's responses was initiated and terminated, were plotted to a common baseline.

2.4.3 Results

The overall response selection performance of subjects appears in Table 2.13. Measurement of skill in carrying out maneuvers is not possible in film simulation since the visual stimulus will not change as a function of the subject's response.

TABLE 2.13: RESPONSE SELECTION PERFORMANCE IN SIMULATION EXPERIMENTS

PHASE	INTERSECTING VEHICLE		LEAD VEHICLE	
	Correct	Incorrect	Correct	Incorrect
Pre-Test	58%	42%	47%	53%
Post-Test	100%	0%	78%	22%

A marked improvement from pre-test to post-test is apparent in both conflict situations. With only three subjects, a test of statistical significance is inappropriate. However, since all three subjects improved in both conflict situations, the results probably reflect genuine improvement.

In the Lead Vehicle conflict situation, the magnitude of improvement may be somewhat greater than that indicated by the percentages. First, in the pre-test, many subjects made the correct response without performing the required set of observations; they simply guessed correctly. In the post-test, correct responses were generally almost always accompanied by the correct observation. Secondly, in the pre-test, the majority of errors involved an attempt to escape into a lane occupied by an adjacent vehicle. They were accident-producing errors. However, in the post-test, most errors involved attempting to drive onto the shoulder (when an adjacent lane was available). They are less likely to have been accident-producing errors.

How much was learned is probably less important to the determination of training requirements than what was learned. Information bearing upon the nature of subject's learning is primarily qualitative rather than quantitative. However, it sheds some light upon the ability of individuals to acquire the various skills involved in collision avoidance and upon the value of film simulation in leading to the acquisition of skills.

PERCEPTION: The perceptual skills involved in coping with Lead Vehicle conflicts are substantially different from those involved in Intersecting Vehicle conflicts. Therefore, the two types of conflicts are discussed separately.

Lead Vehicle Conflicts. The difficulties encountered in attempting to simulate the perceptual skills involved in Lead Vehicle conflicts were alluded to earlier. The lack of noise and vibration, as well as the lack of texture in the visual stimulus, left the subject with little sensation of speed. Subjects perceived themselves as moving much more slowly than the objective speed represented. The addition of sound and vibration might improve the fidelity of simulation, and a more highly textured visual stimulus is likely to be of greater value. Another procedure that might improve the simulation of perceptual requirements would be the use of front projection. This would allow the visual angle subtended by the projected image to be more nearly equivalent to that subtended by an actual vehicle. This might aid in improving the accuracy of distance judgment.

Intersecting Vehicle Conflicts. The improvement in performance is almost entirely a result of perceptual processes, since selection of a response is totally determined by the perception of the conflict. The skills acquired in the experiment differ somewhat from those required on the highway, since the viewing angle itself provided no cue. What allowed the subject to determine the IV's angle was its position relative to the window post which appeared in the film. However, the subjects did learn to apply this perception to the selection of a response. Other cues - the distance of the IV and the change in the viewing angle - were provided by the film stiumulus.

The primary problem encountered arose from a limited field of view obtainable through generally available optical systems particularly when the viewing angle of the IV was greater than 45 degrees. How much value could be gained by using a lens with a wider field of vision is open to question. The projected image would have very low resolution. Moreover, the requirement for a "wraparound" screen would generally preclude its application to group training.

Panning the camera introduces several problems including difficulty for the viewer to determine just what the viewing angle is, even with a fixed reference point, and the introduction of spurious cues. The effect of the spurious cues was negated by the insertion of trials in which the IV was detected at less than a 45° angle but was proceeding more slowly than the car. A subject set to respond to the magnitude of the viewing angle rather than changing magnitude would be fooled. However, all this accomplished was to render the use of camera angle ineffective as a response cue; it did not eliminate its use.

RESPONSE SELECTION: In selecting a response to Lead Vehicle conflicts, the subject was to follow a modified version of the driver behavior diagram shown in Figure 2-9, generated simply to allow study of skill acquisition in response selection. The results indicated learning in the selection of responses. In choosing between braking and moving laterally, eight errors occurred in the pre-test. This was reduced to three errors in the post-test. The results for selection of a move to the right versus a move to the left are a bit complicated. Where the left lane was blocked, three errors (i.e., a move to the left) occurred in the pretest; no errors occurred in the post-test. However, where the left lane was not blocked, three errors occurred in the pre-test while six errors occurred in the post-test. This latter result does not, however, indicate a failure to learn. Since a move to the right, onto the grassy shoulder, was a safe maneuver, the "error" was only a violation of the prescription that a move to the left was to be preferred over a move to the right. In five of the six situations, the subject merely elected to take to the right shoulder without even checking the left lane. In only one case did the subject actually determine that the left lane was free and still make an incorrect selection, that is, an evasive move to the right.

Obviously, the frequencies represented here are very small. However, the performance of the subjects as well as the subject's own reports do provide some interesting information. Where subjects are attempting to "beat the clock" as they were in the post-test, they tend to forget or ignore general instructions - such as move to the left is preferred over a move to the right - and react to what is immediately visible. This suggests that if there is to be a preference of one lane over another, the reason for it must be provided in the visual stimuli that are presented, not in a set of verbal instructions.

MOTOR RESPONSES: The two types of motor responses that subjects were called upon to perform were (1) observational responses - checks of adjacent and following traffic in Lead Vehicle conflicts, and (2) control responses - steering and modulated braking in Lead Vehicle conflicts and Intersecting Vehicle conflicts.

Observational Responses. The analysis of conflict situations described earlier indicates that, in a large number of lead vehicle conflicts, a collision may be avoided simply by braking, or moving into an adjacent lane. A high probability of successful evasion in these cases would require that the driver be able to perform rapid observations of adjacent and following traffic before, or while, initiating a control response. In the experiment, the increase in the number of successful responses from pre-test to post-test suggests that subjects were able to perform the necessary observations. The question is whether they did it quickly enough.

As measured during post-test trials, the times required to carry out the various motor responses range from .4 seconds for the simplest series of responses to a full second for the most complex. Adding the time required to detect the conflict, the total time interval from the initiation of the conflict to completion of required motor responses ranged from .8 second to 1.6 seconds. Certain of the situations required mirror checks for following vehicles, in addition to the left and right observations for lane availability. In the one case in which the rearview mirror check was clearly visible, it was timed at .16 seconds. However, the total response time for situations which required following vehicle checks did not differ from those in which no following vehicle check was required. This means that the mirror check could be made without delaying the performance of other observations.

The critical question is whether completion times were sufficiently short to allow collisions to be avoided. The answer to this question depends totally upon the inter-vehicle distances and vehicle speeds involved. However, the findings are somewhat encouraging. If simultaneous initiation of observational and control responses could, with training, allow responses to be completed in less than a second after a conflict appeared, it would seem that many collisions encountered by untrained drivers would be avoided. Even a 1.5 second completion time would have allowed many reported Lead Vehicle collisions to have been avoided. Furthermore, it was the belief of the examiner and the subjects that additional training would have led to even lower response time.

Control Responses. Very few of the subjects were able to perform the evasive steering and modulated braking responses as they were instructed. This seems somewhat surprising in view of the relative ease with which drivers seem to have learned to carry out the responses in training programs that are conducted on driving ranges. The answer may lie in the fact that the experimental subjects were required to carry out the maneuvers while performing several observational responses and selecting an appropriate control response. Drivers who are learning to perform braking and steering responses on a driving range generally have little else competing for their attention. At most, they are simply confronted with a signal that indicates in which direction they are to turn. One is tempted to question whether drivers who can perform steering and braking maneuvers on a range could duplicate the behaviors in the highway environment where other perceptual, response selection, and observational demands were made upon their attention.

There is no reason to believe that the subjects, given enough time, could not have succeeded in superimposing control responses upon the other activities they were performing. However, the results certainly suggest that the magnitude of the training problem in the area of evasive maneuvers training may be somewhat greater than generally believed.

2.4.4 Summary

The experiments just described provide evidence of limited learning in the acquisition of skills required to respond to simulated collision avoidance situations. The skills which appeared to evidence learning are the following:

Perception - In an Intersecting Vehicle conflict, subjects learned to distinguish between an accelerative and a braking situation, using cues of position, distance, and change in viewing angle.

Response Selection - In Lead Vehicle conflicts, subjects learned to select a braking or steering response based upon a fairly complex response selection process.

Motor Response - In Lead Vehicle conflicts, subjects learned to carry out quickly the observational responses needed in detecting the presence or absence of a vehicle following closely behind and vehicles in adjacent lanes.

Skills that did not appear to be learned through the simulation process used include the following:

Perception - In Lead Vehicle conflicts, subjects could not judge closure with the lead vehicle, owing primarily to the lack of speed cues.

Motor Response - In Lead Vehicle and Intersecting Vehicle conflicts, subjects were unable to perform evasive steering and modulated braking responses properly when they had to be carried out concurrently with perception, response selection, and observational responses.

It is important to recognize that "acquisition of skill" refers here to skills involved in reacting to simulated conflicts. There is no evidence whatsoever that the skills acquired in the experiment can be transferred to an operational automobile or to real world conflicts.

The experiments that were described represent a first step in a process designed to determine whether or not individuals can be instructed to respond correctly to collision avoidance situations. Had no learning been evidenced, it would have been necessary either to (1) decide skills could not be acquired and terminate the study, or (2) repeat the experiment using different procedures and materials. It would not have been possible to move ahead. The results obtained from the limited experiments performed offered enough encouragement to warrant proceeding further.

2.5 SYNTHESIS OF EVENTS AND REQUIREMENTS DATA

This section is a summarization, synthesis and integration of the analyses and preliminary experimentation accomplished during Phase I.(12)

The accident analysis base was 372 accidents involving 613 vehicles studied in Monroe County, Indiana. Table 2.14 illustrates the representativeness of MDAI, Monroe County, and National accident characteristics and driver variables. More detailed analyses of representativeness can be found in section 2.2. Two areas of known underrepresentation of the Monroe County data are freeway accidents and cosmopolitan (congested area) accidents.

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(12) Accident Avoidance Skill Training and Performance Testing, Interim Report and Phase II Work Plan, Contract DOT-HS-4-00960, URS/Matrix Company, PR-0530-09, April 1975.

TABLE 2.14

REPRESENTATIVENESS OF MDAI FILE TO MONROE COUNTY AND NATIONAL DATA

VARIABLES	MDAI vs MONROE CO.	MONROE CO. vs. NATIONAL	MDAI vs. NATIONAL
AGE			
SEX	●	●	●
VEHICLE MAKE	●	●	●
VEHICLE YEAR	●	●	●
VEHICLE TYPE	●	●	●
SYSTEM & TYPE OF ROAD SURFACE	●	●	●
ROAD SURFACE CONDITIONS	●	●	●
URBAN vs. RURAL ACCIDENT LOCATION	●	●	
LIGHT CONDITONS			
TYPE OF ACCIDENT			
ACCIDENT SEVERITY			●

● SIGNIFIES NO STATISTICALLY SIGNIFICANT DIFFERENCES IN DISTRIBUTIONS.

Indiana then defined four major accident situation categories with the number of vehicles involved, as follows:

Group 1.0 - Degraded vehicular performance (21)
Group 2.0 - Environment or driver induced emergency (102)
Group 3.0 - Multivehicle collision (488)
Group 4.0 - Other (2)

Among the 372 accidents studied, 115 (31%) were non-conflict or single vehicle (Groups 1.0, 2.0, 4.0) accidents; the remianing 257 (69%) were "conflict" accidents, available for examination in this project (Group 3.0). Applying the definition of conflict developed for this project (see Section 1.0) Indiana University further classified conflict accidents in terms of avoidance probabilities as shown in Figure 2-10. The result is that 47% of conflict accidents have "certain" ($\geq$.9 probability) or "probable" ($\geq$.7 probability) potential for avoidance via a driver-induced maneuver. Another 9% are "possible" (.5 - .69 probability) candidates for evasion, bringing the total pool of accidents subject to analysis (and potential amelioration) in this project to 47 to 56% of all conflict accidents (32 to 38% of all accidents).

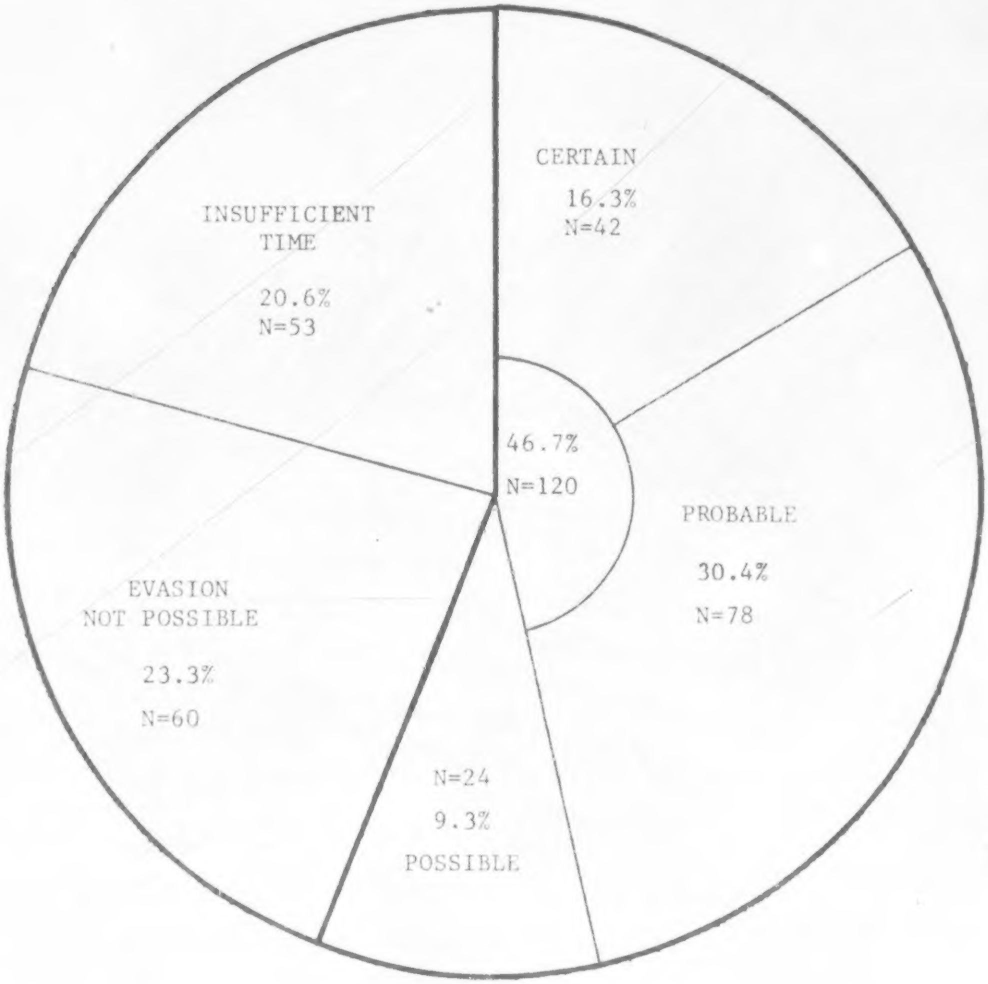
During the in-depth analysis of the accidents comprising these situation groups, investigators attempted to determine whether the driver(s) perceived the danger in time to attempt evasive action, whether or not such evasion was actually attempted. In situation group 3.0, 223 drivers (44.7%) did not perceive the danger in time. For all 613 drivers, 259 (42.25% did not perceive the danger until it was too late. This finding verifies the original report(5)of inattention as a major causal factor in accidents, and has interesting implications for driver education, licensing, and performance research.

Further analyzing the 257 accidents in Situation Group 3.0 (488 drivers), Indiana University identified the seventeen major accident situations shown in Table 2.4, then subclassified these situations for a total of 40 "types" of conflict situations (52 "types" of accident situations, including non-conflict accidents).

Central Missouri State University was also asked to develop a situation taxonomy. Their data base was previous driver task analyses (9) and previously published accident data, i.e., MDAI case summaries. After identifying all possible conflict situations in the task analyses, the researchers diagrammed all the conflict situations and tried to identify any additional

FIGURE 2-10: AVOIDANCE PROBABILITIES IN TRAFFIC CONFLICT SITUATION ACCIDENTS

(257 Conflict Accidents Involving 488 Drivers)



94

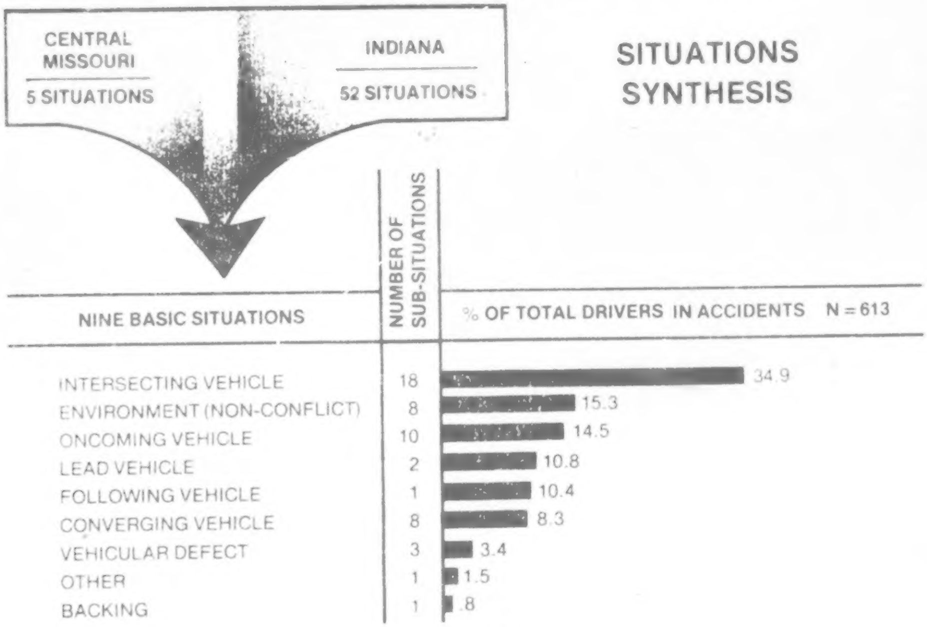
conflict possibilities. After this comprehensive catalog was complete, the process of categorizing and classifying began. The resulting five basic situations are shown in Table 2.15.

TABLE 2.15: TASK ANALYSIS RESULTS - BASIC CONFLICT SITUATIONS

SITUATION	DEFINITION
Lead Vehicle	Rapid closure with a vehicle or obstacle ahead.
Following Vehicle	Rapid overtaking of a following vehicle.
Intersecting Vehicle	Approach of two vehicles on an intersecting course, i.e., right angle.
Converging Vehicle	Convergence of two adjacent vehicles.
Oncoming Vehicle	Approach of two vehicles on a (head-on) collision course.

The two sets of situation taxonomies, one analytic, one empirical, had to be synthesized and the relative importance of each situation established. Figure 2-11 shows that of the nine resulting basic situations, intersection conflicts occur to drivers twice as frequently as any other situation. Note that the non-conflict situations (environment and vehicular defect) are included for comparison purposes.

FIGURE 2-11: SYNTHESIS OF TWO SITUATION TAXONOMIES



Both analysis techniques were also directed at identifying a maneuver taxonomy. As expected, no new useful maneuvers were identified. Basically, some form of directional and/or velocity change can be used to avoid a conflict situation. Thirty-one usable maneuvers were derived empirically (see Table 2.6) and one additional variation came from the task analysis. All the maneuvers are variations of magnitude, timing, and sequence of steering, braking, or accelerating. In current training programs, neither accelerating nor a 90° turn are offered as viable avoidance maneuver options.

The probability of success of each maneuver for each situation was estimated by a rating technique. Several findings are of note. A straight ahead stop was rarely one of the best maneuvers for avoiding a conflict situation. This is a startling finding so its meaning must be examined. First, any situation where there is no other option but straight braking is not considered an accident avoidance conflict (see definition of conflict, Section 1.0). When you are surrounded by cars on both sides and a stopped vehicle is in front of you, there is no place to move so you must attempt to brake as effectively as possible. Secondly, in a conflict, especially converging or intersecting, vehicles may be so close that braking guarantees a collision. The highest probability of successful avoidance in those situations is acceleration. An unresolved dilemma is that if both drivers respond with this avoidance behavior, the potential benefits are cancelled. However, as the Indiana data show, more than 42% of the drivers did not perceive the danger in time to attempt an avoidance behavior, increasing the likelihood that only one driver would respond by accelerating. Third, this finding does not imply that braking technique is not crucial to avoidance, but that braking will usually be performed in conjunction with some lateral movement. The skills to brake and not lose steering control are particularly important in light of the finding that 45% of drivers in conflict situations "locked up" their wheels sometime during their avoidance attempt. Fourth, the empirical analysis included only attempts that failed, i.e., resulted in an accident. There are probably many more near-miss situations where braking did avoid an accident.

These qualifications indicate that the brake only maneuver will continue to be important in driving but in many conflict situations it is not the best action to avoid accidents. Future training will have to consider the type and emphasis of braking training to be included. This is particularly evident when one considers that 38% of the accident drivers in conflict situations who have time to attempt an evasive maneuver attempt the maneuver: "steer straight only and brake with intent to stop before object." Another finding of interest is the apparent value of acceleration as an avoidance maneuver. Among the eighteen sub-situations comprising the intersecting situation three are clearly best avoided by straight ahead acceleration and two others by a lateral movement and acceleration. In the following vehicle situation where a driver is stopped waiting to turn and a car comes up behind, the maneuvers most likely to avoid the accident are accelerate straight ahead or ahead and to the right. (This assumes the left turn cannot be completed.) Again, this finding runs counter to driver education and evasive training offered currently in this country.

As anticipated, many of the situations have several maneuvers rated very close in probability of success. A driver's selection to go right versus left, stop before or continue by a conflicting vehicle are strongly influenced by the characteristics of each impending collision. Since this variance in constraints is highly specific it cannot be considered in the situation taxonomies. If it were, each accident would represent a situation- an obviously useless result. Instead, Indiana University applied an environment constraint, or conduciveness, rating at the same time maneuver success probabilities were estimated. The result was an index stated as a proportion, for each maneuver in each of the situation categories. A new set of maneuver success probabilities was calculated so that environmental conduciveness for each maneuver was included. In general, environmental hindrance for the maneuvers (averaged across situations) ranged from .07 to .26. (This can be thought of as 7 to 26% of the time there will be an environmental hindrance.) Not surprisingly the steering maneuvers, particularly to the left, had the highest hindrance proportions. The implication of this factor for training is that simple stimulus (situations) response (maneuver) chains will not be appropriate for accident avoidance. Training will have to produce a more flexible, adaptive capability in the driver if he is to be able to select a response which is best in terms of the traffic and environmental situation.

So far we have noted the situation taxonomy, maneuver taxonomy and probabilities of success of maneuver for each situation with environmental constraints included. These results emanate primarily from the accident data; however, as was shown, they are completely compatible with the task analysis results.

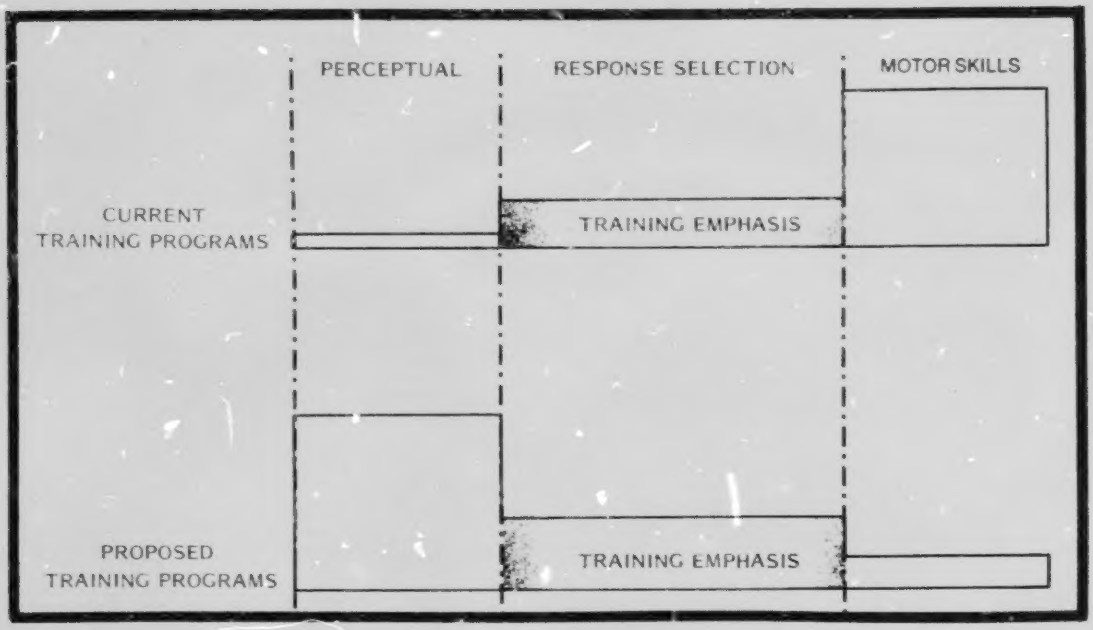
When it comes to the derivation of the behavioral requirements of accident avoidance, accident data provides little information. Task analysis and experimental procedures, however, can provide the necessary detail. Each of the five major situations were analyzed separately from a behavioral viewpoint. A flow of behaviors was charted along a timeline. After the first analysis was complete it was evident that a driver in a "compressed" time conflict would not be able to go through all the behaviors listed. All redundant, marginally useful behaviors were eliminated. The result was a catalog of the minimum behavioral and information processing sequences necessary for avoidance in any of the five situations (Figures 2-5 through 2-9). Once all situations had been analyzed, behaviors could be catalogued and prioritized. While frequency of occurence is often of interest it is not the most meaningful indicator of importance of a behavior to successful accident avoidance. Location in the behavioral flow and dependence of subsequent behavior on output from preceding behaviors is more indicative of behavioral significance.

Examining the behavioral flow charts clearly reveals the primacy, pervasiveness and subsequent dependencies characterizing information processing. Over two-thirds of accident avoidance behaviors fall in this domain and they always occur before any motor response is initiated. Information processing is further delineated into perceptual and response selection behaviors. Perception typically occurs first and provides the information necessary to make the response selection.

Current accident avoidance training programs shown in the conceptual diagram of Figure 2-12 place very heavy emphasis on training of motor skills with little or no training in the other areas. According to the findings reported here perceptual and response selection behaviors should receive an increased proportion of training emphasis. This is not to imply that motor skill training should be deemphasized. Instead, motor skill training may have to be performed in a high fidelity setting demanding use of perceptual cues to select appropriate responses. Each of the skill types may initially be trained separately; however, at some point all components will have to be trained together to develop realistic sequencing, timing, and interaction. Beyond that, a question still unanswered is what amount of practice in either of the behavioral areas is required for effective and lasting transfer from training to real world driving. The answer appears to involve achieving valid performace criteria, rather than determining needed amounts of training time.

FIGURE 2-12

COMPARISON OF CURRENT AND PROPOSED TRAINING PROGRAM CONCEPTS



Considering each behavioral area in greater detail revealed four perceptual skills. In terms of frequency of use and criticality of accuracy, the judgment of closure is of paramount importance. Closure must be determined by a driver from several different perspectives, depending on the situation. Simple closure factors include the rate an intersecting vehicle is approaching, the rate the car is closing on a vehicle or object ahead and the car's decelerative/accelerative capability. Compound closure refers to the oncoming car situation where the driver must integrate two vehicles' speeds/distances to arrive at an estimate. Closure rate is an element in all five situations. Second is judgment of clearance which refers to determining if there is room for the car to clear a vehicle or object ahead or to fit between obstacles such as a stopped car and a light pole. Third is direction of vehicle motion. This seems rather obvious but in certain situations, e.g., night situations with considerable visual clutter or a fallen object bounding around in the road, it may be difficult to determine. Fourth is the perception of surface condition. This is relevant since the type or severity of avoidance maneuver depends on the ability of the car to track or stop on the road, shoulder, or other surface.

Six basic response selections were identified. An interesting finding was that not all the six choices listed below had to be considered in every conflict situation.

RESPONSE SELECTION CHOICES

1. Braking versus moving laterally
2. Moving right versus moving left
3. Acceleration versus braking
4. Choice of braking technique
5. Move away from or toward a converging vehicle
6. Choice among collisions

Also the accident data suggested that drivers pick their path first, then change velocity. (As we've seen the path is frequently "go straight".) The task analysis indicates that the sequence of choices varies depending on the situation. This leaves another unsolved question. What strategy should be used in making a response selection? The experiments conducted to date do not provide a clear answer and further field work is recommended to determine an optimum response selection strategy.

The motor skills (responses) identified in Table 2.16 are similar to those already well known in accident avoidance training. One exception is the potential use of a 90° turn which requires a slightly different use of controls. An optimum method of performing the maneuver is not known and would have to be further developed in range testing.

TABLE 2.16: MOTOR RESPONSES IDENTIFIED FOR ACCIDENT AVOIDANCE

BASIC RESPONSES	ANCILLARY RESPONSES
1. CAR CONTROL RESPONSES • EVASIVE STEERING • RAPID BRAKING • RAPID ACCELERATION • SKID RECOVERY • IMPACT RECOVERY	2. VEHICLE ORIENTED RESPONSES • OBSERVATION • SIGNALS 3. BODY POSITION RESPONSES • FRONT IMPACT • REAR IMPACT • SIDE IMPACT

Indiana University performed an analysis of the MDAI accidents to determine the potential role of the car horn in avoiding accidents. A rating scheme was used resulting in certain, probable, or possible benefit determinations. Only 1.9% of drivers aware of a conflict situation would gain a "certain" benefit while 32.5% would derive a "certain, probable or possible" benefit. This benefit was not statistically associated with any particular situation.

As noted earlier the definition of conflict adopted for this project precluded further consideration of single car accidents. The rationale was: it appeared that any behavior or skill required to avoid a dynamic two-car conflict would transfer readily to the generally less complicated single-car situation where only one of the players in the accident scenario is dynamic. In other words, the skills required to steer back onto a roadway, recover from a skid, or avoid a fixed lamp post will be identified in the two-car conflict analysis and training activities. The perceptual skills and motor responses identified appear to verify that line of thinking. However, another aspect of single-car accidents is left unanswered. To what degree would accident avoidance skills enable drivers to evade or minimize non-conflict single car crashes? Further analysis of the Indiana University file will be required to complete this part of any benefit analysis.

At this point in the project, the majority of the analytic work was completed, but a variety of remaining questions could only be answered using experimentation. Ability of drivers to acquire the motor skills of accident avoidance have been amply demonstrated during the past decade, however, such a demonstration for perceptual and response selection skills is not available. Therefore, a limited capability/fidelity simulator was constructed, motion pictures of conflict situations were taken for stimulus materials, and a small number of subjects were pre-tested, trained, then post-tested. A limited set of collision avoidance skills in two situations (See paragraph 2.4.2) was selected for study, using three subjects. The results of those tests are presented in Table 2.13.

The skills which appeared to evidence learning are the following:

Perception - In an Intersecting Vehicle conflict, subjects learned to distinguish between an accelerative and a braking situation, using cues of position, distance, and change in viewing angle.

Response Selection - In Lead Vehicle conflicts, subjects learned to select a braking or steering response based upon a fairly complex response selection process.

Motor Response - In Lead Vehicle conflicts, subjects learned to carry out quickly the observational responses needed in detecting the presence or absence of a vehicle following closely behind and vehicles in adjacent lanes.

Skills that did not appear to be learned through the simulation process used include the following:

Perception - In Lead Vehicle conflicts, subjects could not judge closure with the lead vehicle, owing primarily to the lack of speed cues.

Motor Response - In Lead Vehicle and Intersecting Vehicle conflicts, subjects were unable to perform evasive steering and modulated braking responses properly when they had to be carried out concurrently with perception, response selection, and observational responses.

The results obtained from the limited experiments performed offer enough encouragement to warrant proceeding further.

2.6 PHASE I CONCLUSIONS AND RECOMMENDATIONS FOR PHASE II

The major question to be addressed at the end of Phase I was "Is there sufficient evidence that drivers can be trained to avoid collisions to warrant continuation of this program into the next phase?". In response we have seen the successful use of accident and task/behavioral investigation methodologies to generate and verify taxonomies of accident avoidance (conflict) situations and maneuvers.

The behavioral requirements for executing those maneuvers were identified and experimentation indicated that perceptual and response selection skills can be acquired through training. Evidently much of it will have to be in training settings utilizing other than film simulation. Thus far the indicators for program continuation appear generally positive. To provide more evidence a determination of probable program effectiveness should be made.

A benefit analysis* was made by calculating the potential reduction in accidents which would have been realized if one of the drivers involved in each traffic conflict accident had correctly implemented an avoidance maneuver with a high probability of success (Ps) for that conflict situation. For each composite conflict accident category (e.g., Head-on, rear-end, etc.) reported by Indiana University (2), the accident situation category contributions were determined (e.g., a "lead vehicle conflict" plus a "following vehicle conflict" results in a "rear-end collision"). The average probability of successful avoidance was calculated for each accident situation category by identifying the two maneuvers, for each contributing situation, which had the highest probability of success, and averaging them for the accident situation. The resulting Ps was then multiplied by the number of instances within the accident situation category where at least one of the involved drivers perceived the danger in time to have attempted an evasive maneuver. The number which resulted represented the potential number of accidents (within that accident situation category) which could have been avoided. An example of this calculation is shown in Table 2.17. The reductions were then summed for the composite accident category. The results of this analysis for all accident categories is presented in Table 2.18, based upon the 372 accidents investigated by Indiana University.

It is not realistic, however, to assume that training of the sort envisioned in this project would always enable a driver to correctly choose and apply the highest Ps maneuver to the appropriate situation. The project did not find directly applicable literature or generate experimental data on how effective training might be, so levels of 25% and 50% training effectiveness

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*The benefit analysis reported in Reference 12 has been revised and updated for this report, using final maneuver probabilities of Reference 2.

TABLE 2.17: EXAMPLE OF CALCULATIONS FOR DETERMINING ACCIDENT REDUCTION POTENTIALS

COMPOSITE ACCIDENT CATEGORY	CONTRIBUTING ACCIDENT SITUATIONS	NO. OF ACCIDENTS	NO. OF ACCIDENTS WITH AT LEAST ONE DRIVER PERCEIVING DANGER IN TIME	SITUATION NO.	TOP 2 MANEUVERS PER SITUATION		Ps SUM	AVERA Ps
-					#	Ps		
REAR-END COLLISIONS (LEAD & FOLLOWING VEHICLES)	3.8-3.9	48	38	3.8	7.3 6.3	.474 .466	2.140	.53
				3.9	6.4 0.4	.691 .509		
	3.8-3.9-3.9*	7	5	3.8	7.3 6.3	.474 .466	3.340	.5
				3.9	6.4 0.4	.691 .509		
				3.9	6.4 0.4	.691 .509		
	3.8 SVCA**	5	5	3.8	7.3 6.3	.474 .466	0.940	.4
	TOTAL	60	48					

* Chain Reaction Accident

** Single Vehicle Collision Avoidance

MPLE OF CALCULATIONS FOR DETERMINING ACCIDENT REDUCTION POTENTIALS

OF DENTS	NO. OF ACCIDENTS WITH AT LEAST ONE DRIVER PERCEIVING DANGER IN TIME	SITUATION NO.	TOP 2 MANEUVERS PER SITUATION		Ps SUM	AVERAGE Ps	POTENTIAL NO. OF ACCIDENTS AVOIDED
			#	Ps			
3	38	3.8	7.3 6.3	.474 .466	2.140	.535	20.30
		3.9	6.4 0.4	.691 .509			
7	5	3.8	7.3 6.3	.474 .466	3.340	.557	2.78
		3.9	6.4 0.4	.691 .509			
		3.9	6.4 0.4	.691 .509			
5	5	3.8	7.3 6.3	.474 .466	0.940	.470	2.35
)	48						25.43

dent

ision Avoidance

TABLE 2.18: POTENTIAL FOR ACCIDENT REDUCTION BY ACCIDENT CATEGORY

COMPOSITE ACCIDENT CATEGORY	CONFLICT SITUATION NUMBERS INCLUDED	NUMBER OF ACCIDENTS	NUMBER PERCEIVED IN TIME*	POTENTIAL NUMBER OF ACCIDENTS AVOIDED	REDUCTION % **		
					CATEGORY	TOTAL MV CONFLICTS	ALL ACCI-DENTS
HEAD-ON COLLISION	3.6; 3.7	39	34	18.10	46.4	7.4	4.9
REAR-END COLLISION	3.8; 3.9	60	48	25.43	42.4	10.3	6.8
INTERSECTING VEHICLE COLLISION	3.1; 3.2; 3.3; 3.4; 3.5.	113	91	24.28	21.5	9.9	6.5
ADJACENT VEHICLE COLLISION	3.10; 3.11; 3.12; 3.13	27	17	7.44	27.6	3.0	2.0
OTHER MULTI-VEHICLE ACCIDENTS	3.14; 3.15; 3.16	7	7	2.31	33.0	0.9	0.6
TOTAL MULTI-VEHICLE CONFLICTS		246	197	77.56	31.5	31.5	20.8
ALL OTHER ACCIDENTS		126	90	***	***	***	***
ALL ACCIDENTS		372	287	77.56	20.8	-	20.8

* Number of accidents with at least one driver perceiving the danger in sufficient time to attempt evasive maneuver.

** At 100% effectiveness.

*** Not calculated.

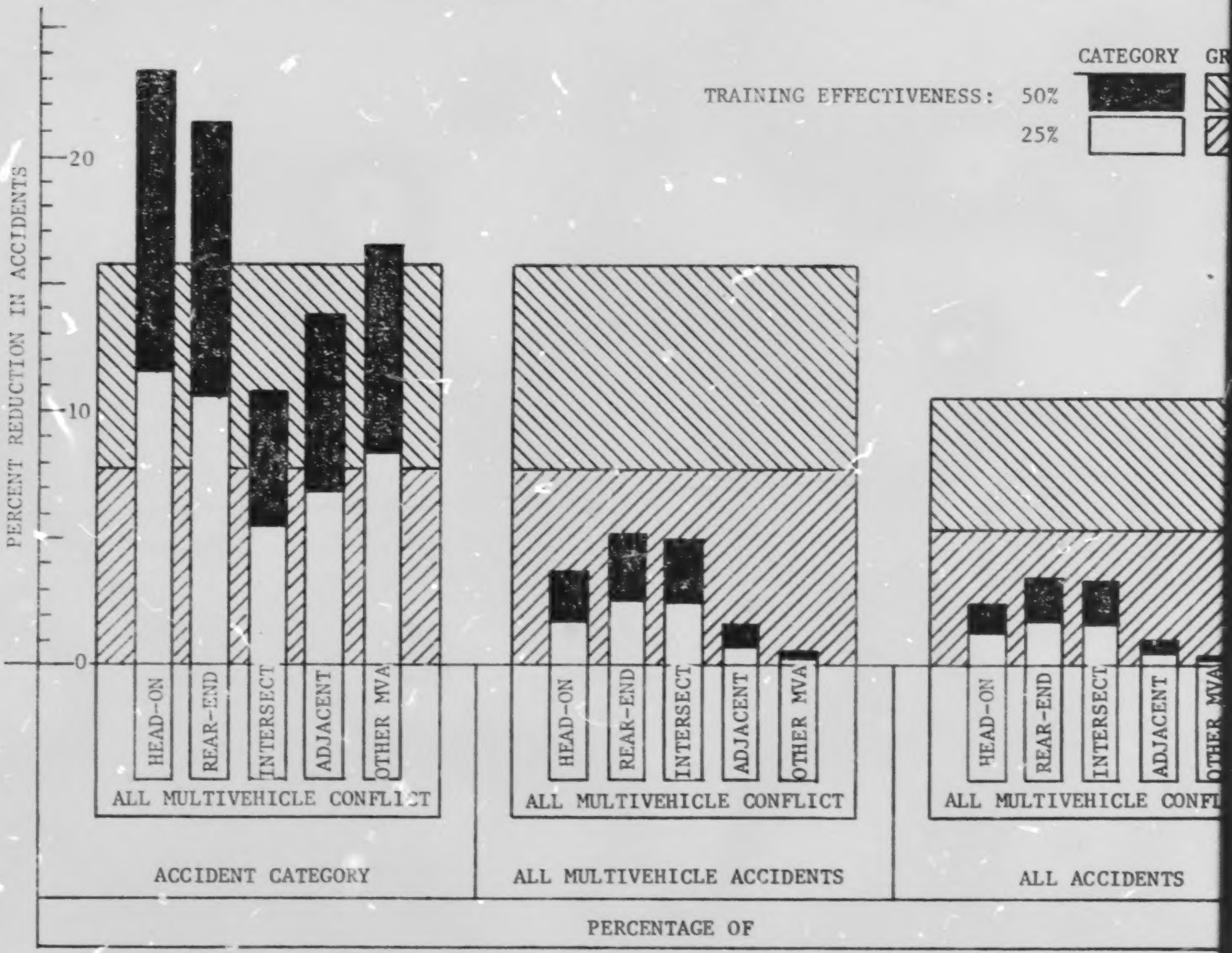
were selected for analysis purposes. The accident reductions calculated earlier were multiplied by .25 and .50 and the results plotted in the percent accident reduction chart in Figure 2-13. This chart shows the contribution of each accident category to potential accident reduction. The first section illustrates the potential reductions within accident categories (e.g., head-on collisions may be reduced by 23.2% at 50% training effectiveness); the second, center section presents the reductions as percentages of all multivehicle conflict accidents (e.g., with a 23.2% reduction in head-on collisions, at 50% effectiveness, we can expect a 3.7% reduction in the number of multiple vehicle conflict accidents); likewise, in the last section of the chart we see that the reduction in head-on collisions results in a 2.4% reduction in all motor vehicle accidents, at 50% training effectiveness. It is unlikely that training effectiveness will ever be greater than 50% so the maximum program effectiveness would be 10.4% reduction in all accidents. This factor does not take into consideration the environmental hindrance variable which ranged from 6-26%. Another factor, illustrated in Figure 2-14, is the unknown amount of benefit which will be gained among the single car accidents. Considering all these factors, a realistic estimate of accident reduction potential as a result of accident avoidance training appears to be 5-10% of all accidents. As shown in Table 2.19, in 1974 that would have meant between 780,000 and 1,560,000 accidents avoided.

In terms of severity, the Indiana University data slightly over-represented greater accident severity, due to the constraints of the MDAI system, and the nature of the data collection process. Unfortunately a severity and accident cost analysis by situation category will not be performed until later phases of the project; however, there appears to be no reason to suspect only less severe accidents will be avoided as a result of training. For comparison purposes, in Table 2.19, a uniform cost per accident was assumed based on data in References 13 and 14.

Based on the analytic, empirical, and benefit analyses presented in the foregoing, there was adequate justification and promise to continue the program, and continuance was recommended with some modification to the original plan, as follows:

1. The experimental medium (film simulation) used in Phase I is not adequate for studying questions raised in Phase I. These include:

FIGURE 2-13: ACCIDENT REDUCTION PERCENTAGES FOR TWO TRAINING EFFECTIVENESS LEVELS



ACCIDENT REDUCTION PERCENTAGES FOR TWO TRAINING EFFECTIVENESS LEVELS

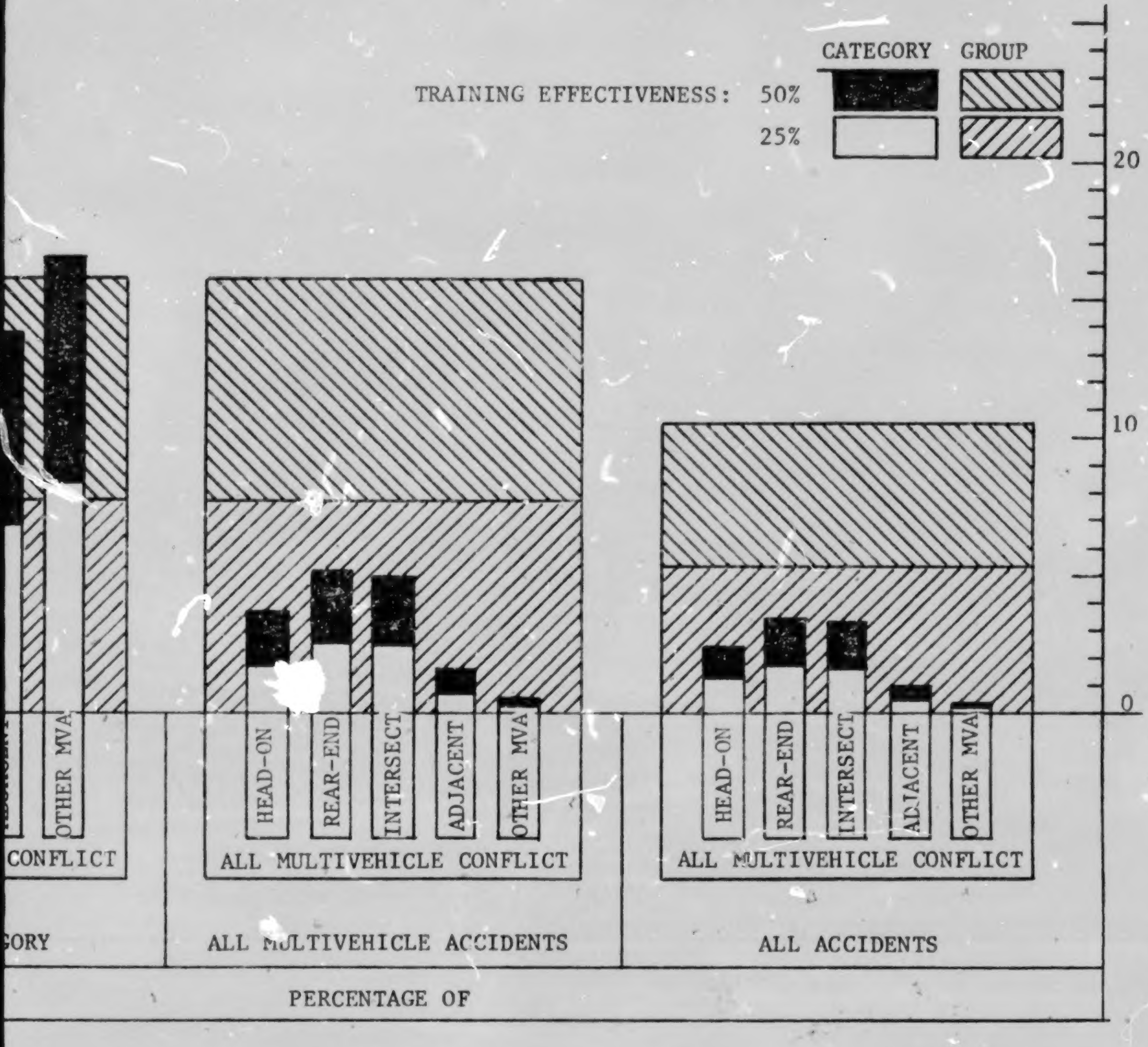
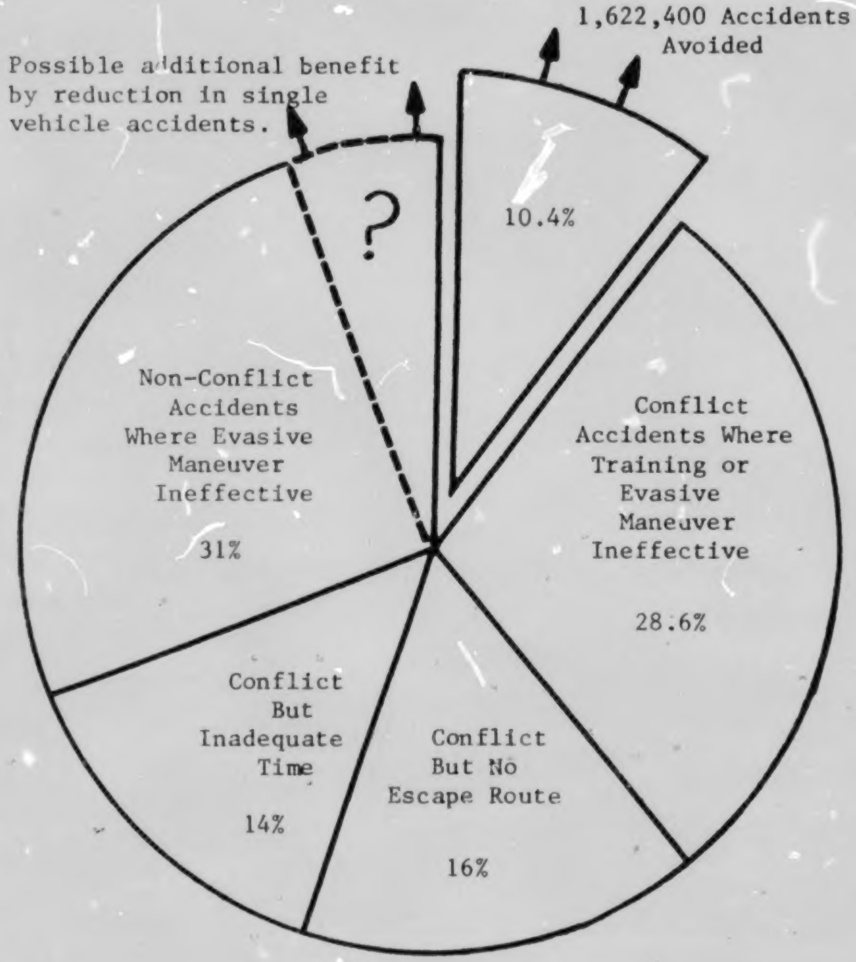


FIGURE 2-14: POTENTIAL EFFECT OF ACCIDENT AVOIDANCE SKILL TRAINING ON NATIONAL ACCIDENTS ASSUMING 50% TRAINING EFFECTIVENESS



1,622,400 Accidents Avoided

Possible additional benefit by reduction in single vehicle accidents.

811,200 Accidents Reduced At 25% Level of Training Effectiveness

1974 Accident Totals from NSC(13)

TABLE 2.19: ACCIDENT REDUCTION POTENTIAL OF COLLISION AVOIDANCE TRAINING

ACCIDENT RATE (13,14)		TRAINING EFFECTIVENESS LEVEL	% REDUCTION	# OF ACCIDENTS AVOIDED	REDUCTION IN ACCIDENT COSTS ($ MILLION)
YEAR	# OF MOTOR VEHICLE ACCIDENTS				
1973	16,600,000	50%	10.4	1,726,400	2,100.8
			10.0	1,600,000	2,020.0
		25%	5.2	863,200	1,050.4
			5.0	830,000	1,010.0
1974	15,600,000	50%	10.4	1,622,400	2,007.2
			10.0	1,560,000	1,930.0
		25%	5.2	811,200	1,003.6
			5.0	780,000	965.0

- Is there transfer of training from simulation to actual vehicles?
- Can the perceptual, response selection and motor response skills be trained to a useable level of proficiency?
- How much training time (practice) is required for retention?
- What are the retention characteristics of the skills being trained?
- Should perceptual response selection and motor response skills be decoupled at first then integrated later in training or should the integrated behaviors be trained at the outset but at slow, drawn out speeds eventually building to real-time situations?
- How can conflicts be studied if film simulation is inadequate and full-scale vehicles are too hazardous and/or expensive?

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(13) Accident Facts, 1975 Edition, National Safety Council, 1975 (for 1974 accidents).

(14) Accident Facts, 1974 Edition, National Safety Council, 1974 (for 1973 accidents).

Therefore, the use of scaled down low-mass (noninjurious) vehicles/environments should be explored and if feasible used both as research and training tools.

2. The question of who should be trained in accident avoidance was not addressed during Phase I (it was not part of the contract scope of work). The literature search did reveal a paucity of information on emergency vehicle operator accidents. A study gathering enough of this type information to recommend applicability of the training for this driver group should be conducted.

3. Several issues in the accident data were unresolved. These would allow substantial refinement of the benefit analysis done in Phase I. Topics included are:

- Detailed analysis of single car accidents.
- Analysis of small samples of freeway and congested metropolitan accidents (N of 25 each would be sufficient).
- Carry out a severity analysis by situation category and success probability.
- Complete work begun on driver error analysis. Apply procedures developed to the first three phases of the Indiana University MDAI program.

4. Consider the project as an experimental endeavor in addition to a curriculum development activity. The difficulties in determining optimum response strategies and adequately training perceptual skills warrant maintaining a flexible posture so training can be modified or changed as evaluation data indicates the need. The final product will be a more soundly conceived and empirically based set of training requirements and techniques which can readily be developed into a formal curriculum as part of Phase III.

3.0 PHASE II - TRAINING PROGRAM DEVELOPMENT

3.1 PHASE II OVERVIEW

At the completion of Phase I, a plan was prepared for conduct of Phase II which projected continuation of the program as originally conceived, but with some portions expanded in accordance with the conclusions and recommendations of Phase I. The primary focus of the expansion recommendations was to provide a means of answering some of the research questions raised during Phase I and increase confidence in the final products of Phase I and II. Approval of the Phase II Work Plan, however, did not include the proposed optional efforts. Consequently, Phase II was initiated based on the guidelines projected at the beginning of Phase I and on the results achieved during Phase I.

The principal objective was to extract sufficient information from the existing literature and from the Phase I findings to prepare, and test the effectiveness of, a prototype accident avoidance training curriculum.

The initial task in Phase II, that of preparing a candidate curriculum and performance measurement specification, was accompanied by many difficulties. Surveying the driver education literature for techniques to be used for training the critical conflict maneuvers identified in Phase I resulted in two fundamental conclusions:

1. That the most effective way to develop basic vehicle operating skills is through behind-the-wheel, real world practice;
2. That current fixed base and driving range based simulations do not provide the breadth of high fidelity perceptual cues to support the development of critical driver skills in data acquisition, strategy selection and strategy implementation.

Practicing accident avoidance techniques and strategy selection on the open road (or on the driving range for that matter) using two or more real cars presents an unacceptably high risk. Therefore, such a technique could not seriously be considered for implementation in the training program being developed. For this reason, some method of conflict simulation was determined to be necessary. A survey of simulator state-of-the-art revealed that there are currently no entirely suitable simulators available to support the training requirements and those which provide reasonably high fidelity simulation had an accompanying exorbitantly high cost. It thus became necessary for URS/Matrix to conceptualize and begin implementing a new training technology.

The first attempt to specify the training program followed a traditional approach of curriculum development for driver education programs. It became apparent, however, that the resulting specification would neither adequately identify the methods and procedures to be used nor provide the basis for development of materials and equipment to meet course objectives. A second specification, reformatted and much more specific and detailed, was then developed, calling for a modularized training/testing program and identifying specific resources needed for the program.

Based on the early identification of the need for a driving simulator which would provide visual feedback to the operator of the dynamics of a multivehicle conflict situation, a "bimodal" driving simulator was defined, and subsequently developed in a prototype configuration. In addition, efforts were initiated to prepare, procure, or otherwise provide the other materials needed for the specified Accident Avoidance Skill Training (AAST) program. As part of this effort, a method was defined which will permit simulation of multivehicle conflicts on a driving range without the risks inherent in potential two-car collisions.

Throughout this process, in both Phase I and Phase II, questions and problems were identified which could significantly impact the outcome of the program. We are now at the point where the early commitment by the NHTSA to the original objectives of the program must be re-evaluated. If the program is to provide any valid answer to the questions - "Can drivers be trained to have the skills necessary to avoid accidents?" and "Will the possession of such skills assist drivers in avoiding accidents in the real world?", then the resources and time must be provided to resolve the more significant research problems and issues, as well as to permit the development of a complete training program.

Section 3.2 presents a discussion of the process used in developing the curriculum specification. A description and discussion of the "Bimodal Simulator" is contained in section 3.3, and the "Advanced Driving Range" concept is described in section 3.4.

3.2 TRAINING/TESTING REQUIREMENTS DEFINITION

At the outset of the Accident Avoidance Skill Training and Performance Testing program it was intended that the results of the analyses from Phase I would be the input to the specification of instructional objectives, approaches, methods and materials, devices, and performance measures for accident avoidance skill(s). Basically, these materials were to be designed to transmit what successful drivers do in terms of avoiding near accidents in a manner that would enable other drivers to be successful. A "specification" was to be developed using an analytical technique or model that would enable accident-related task analysis material to be transformed into a driver curriculum. The curriculum and performance measurement specification was to reflect the most modern curriculum design, measurement systems, instructional, and pedagogical techniques. Table 3.1 presents the topics which the specification was to address. In addition, it was an objective to determine and document the training/testing sequence, time requirements, trainee practice requirements, and the need for retraining in order to maintain operator skill in accident avoidance on a long-term basis.

Examination of the outputs of Phase I, to be used as inputs to this task, revealed the following items to be available:

- A taxonomy of accident situations based on in-depth investigation of accidents, which provided data on the types of motor vehicle accidents which actually occur, the conditions under which they occur, and the frequencies with which the various types occur.
- A taxonomy of potentially useful maneuvers for avoiding conflict accidents, derived both empirically and through formal analysis.
- Great quantities of information, both published and unpublished, regarding the "best" approaches and techniques for driver education and training.
- A preliminary assessment of the capability of drivers to learn new perceptual, response selection, and motor response skills for application in a collision avoidance situation.
- A preliminary analysis of the strengths and weaknesses of some types of driver training techniques and equipment, and their applicability to collision avoidance training.

The intial attempt at developing a curriculum specification based on these inputs quickly revealed the error of the assumption that traditional methods of driver training could be used. This "first cut" specification described the objectives to be met and a general instructional approach to be used. The

TABLE 3.1: TOPICS TO BE ADDRESSED IN CURRICULUM AND PERFORMANCE MEASUREMENT SPECIFICATION(S)

1. Instructional Objectives
   - a. Knowledge
   - b. Skill
   - c. Affective
2. Material Requirements
   - a. Student Aids
   - b. Teacher Aids
3. Training Support Requirements
   - a. Personnel
   - b. Standard Training Equipment
   - c. Special Devices (e.g., full or part task driving simulators)
   - d. Facility/Resource Needs & Essential Exercise Areas
4. Prerequisite Trainee Capabilities (specified quantitatively)
   - a. For Training Program
   - b. For Training Event or Maneuver within the Program
5. Measurement Devices/Instruments
   - a. Skill
   - b. Knowledge
6. Administration of Training/Testing
   - a. Guidelines
   - b. Manuals
   - c. Instructional/Testing Conditions

specification - and consequently the training program which would have resulted - was structured to separately treat the skills involved in vehicle control, response selection, and conflict perception. Each of the conflict situations resulting from Phase I analyses was reflected in each of the skill oriented segments. Evaluation of this approach resulted in a decision to reorient the instructional approach to focus on the conflicts rather than the skills per se, since each conflict situation would require the driver to call up and implement a slightly different arsenal of avoidance skills.

The first step in establishing a curriculum for training was to identify the "objects" of training, i.e., the traffic conflict sitautions. The nine basic situations identified in Phase I (Figure 2-11) formed the basis of this endeavor, from the driver's perspective:

- Intersecting Vehicle
- Environmentally Induced
- Oncoming Vehicle
- Lead Vehicle
- Following Vehicle
- Converging Vehicle
- Vehicular Defect
- Other
- Backing

In order to concentrate the training program on accident situations which were both within scope and which contributed significantly to accident experiences, all "non-conflict" situations were eliminated from consideration as well as the less frequently occurring accidents. Remaining under consideration were Intersecting, Oncoming, Lead, Following, and Converging Vehicle situations (the Five Basic Situations depicted in Table 2.15). Subsequently, the Converging Vehicle situation was also deleted. The rationale for this decision was that, of the five, converging vehicle conflicts were the least frequently occurring. In addition, the characteristics of the situation differed primarily in terms of path angles from the intersecting, lead, and following vehicle conflicts. The final selection of conflict situations to be treated included a decision to "split" the intersecting vehicle situation into two discrete topics characterized by the "threat versus obstacle" nature of the conflict (Note that the other three conflicts are either a threat to the driver or an obstacle to the progress of his vehicle). Thus, the Intersecting Vehicle (IV) conflict was divided into two situations: (1) the IV will strike the subject's car (threat); (2) the IV will be struck by the subject's car (obstacle).

The five conflict situations for training having been selected, the next step was to integrate them with the skills to be trained (perceptual; response selection; motor response) and the training techniques to be utilized (classroom instruction; practice through conflict simulation; practice "behind-the-wheel").

Figure 3-1 illustrates the factors contending for consideration as the point of departure in curriculum specification development. As indicated earlier, it was decided that the conflict situations were the unique topic of the program, and that the other contending factors must be integrated with, or superimposed on, the conflict situations. To accomplish this objective, a modular/submodular format was selected in which each of the five conflict situations comprised a module of the training program. The skill factors and training modes were integrated at the submodular level.

To the five conflict situations were added two others: (a) a module to orient the student to the course and to develop advanced vehicle handling skills; (b) a module to administer a comprehensive performance test. Table 3.2 presents the structure of the training program, together with the factors which lead to this format. Figure 3-2 illustrates how the modular format was extended to the submodular level, based on the mode of instruction. One of the attributes of this format is flexibility of administering the program. Figure 3-3 illustrates how the nominal training program can be modified, in terms of sequence and length of instruction, to accomodate local resources and requirements.

The specification which resulted from these efforts is included as Appendix B to this report. It must still be considered as preliminary since it has not yet been validated through conduct of a training program. A description of the program, as projected in the Curriculum Specification follows.

CURRICULUM SPECIFICATION: Requirements are set forth in the specification that are expected to assure that the training course being developed will aid student drivers facing conflict situations in executing workable accident avoidance strategies. Definitively, the collision avoidance strategies to be taught and learned are, or are adaptations of, those recommended by Indiana University (IU) as a result of a comprehensive accident

FIGURE 3-1: FACTORS TO BE INTEGRATED INTO ACCIDENT AVOIDANCE TRAINING AND TESTING CURRICULUM SPECIFICATION

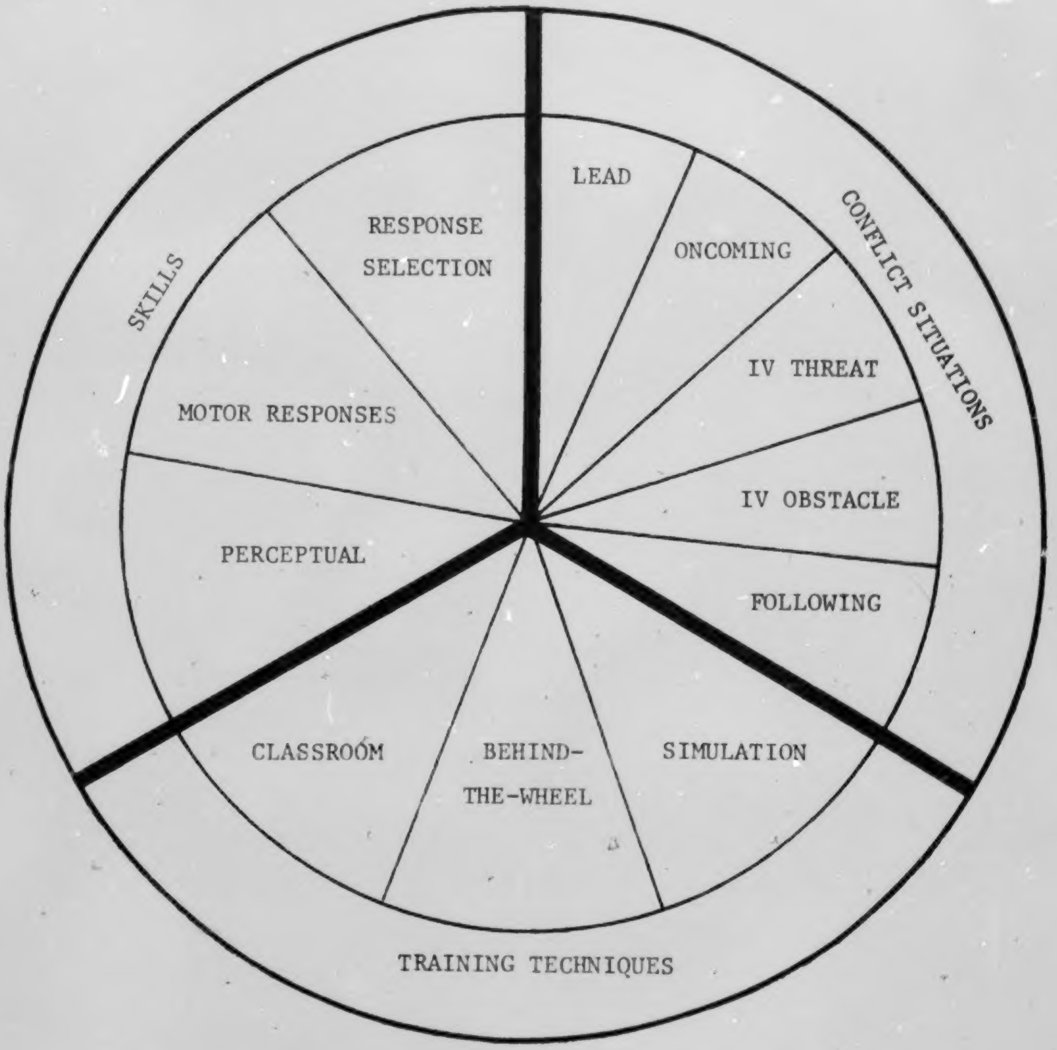

SKILLS
RESPONSE SELECTION
MOTOR RESPONSES
PERCEPTUAL
CONFLICT SITUATIONS
LEAD
ONCOMING
IV THREAT
IV OBSTACLE
FOLLOWING
CLASSROOM
BEHIND-THE-WHEEL
SIMULATION
TRAINING TECHNIQUES

TABLE 3.2: MODULAR ORGANIZATION OF TRAINING PROGRAM

MODULES	I.	ORIENTATION & GENERAL ADVANCED SKILLS	
	II.	COLLISION AVOIDANCE	• INTERSECTING VEHICLE THREAT
	III.		• INTERSECTING VEHICLE OBSTACLE
	IV.		• FOLLOWING VEHICLE THREAT
	V.		• LEAD VEHICLE OBSTACLE
	VI.		• ONCOMING VEHICLE THREAT
	VII.	COMPREHENSIVE COLLISION AVOIDANCE TEST	
CHARACTERISTICS	• ACCIDENT DATA (TYPES & RATES) → MODULES • CONTINUITY AND FLEXIBILITY • ONE PROBLEM AT A TIME • BASIC SKILLS → ADVANCED SKILLS → AVOIDANCE SKILLS • MODULAR ORGANIZATION CONTINUED AT SUBMODULAR LEVEL • EXPAND OR CONDENSE ACCORDING TO RESOURCES AND NEEDS		

FIGURE 3-2: SUBMODULAR ORGANIZATION OF TRAINING PROGRAM

- EACH MODULE CONTAINS A SERIES OF SUBMODULES
- SAME BENEFITS AS AT MODULE LEVEL EXCEPT GREATER INTERDEPENDENCE
- COMBINATIONS OF SUBMODULES MAKE UP UNITS OF INSTRUCTION
- OBJECTIVES AND RESOURCE REQUIREMENTS SPECIFIED AT SUBMODULE LEVEL
- REQUIREMENTS IDENTIFIED IN TERMS OF USE:
  - STUDENT REQ'TS (REFERENCE DATA, HANDOUTS, ETC.)
  - INSTRUCTION REQ'TS (GUIDES, VISUAL AIDS, EQUIPMENT, ETC.)
  - EVALUATION REQ'TS (CHECKLISTS, PERFORMANCE RECORDS, ETC.)
  - SUPPORT (PERSONNEL, FACILITIES, ETC.)

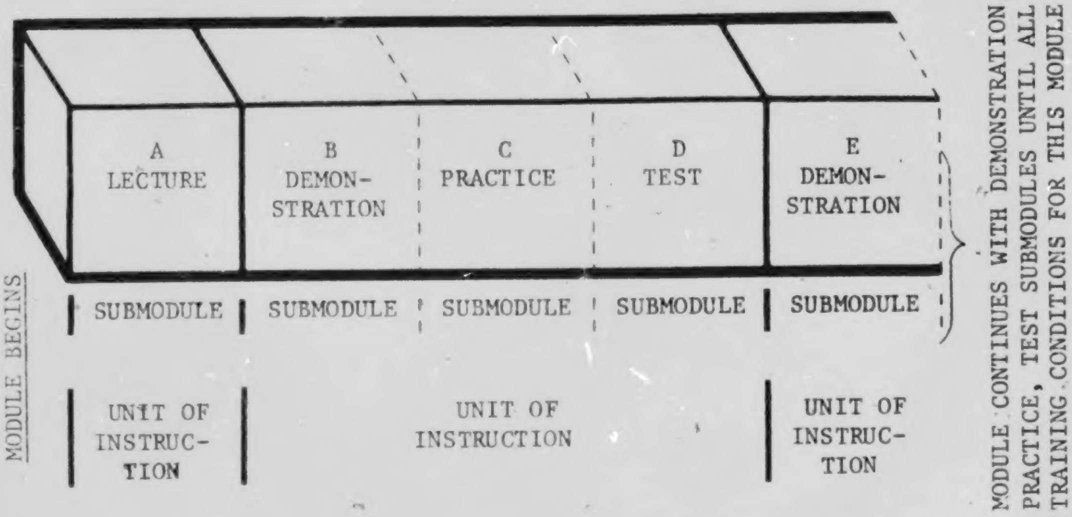
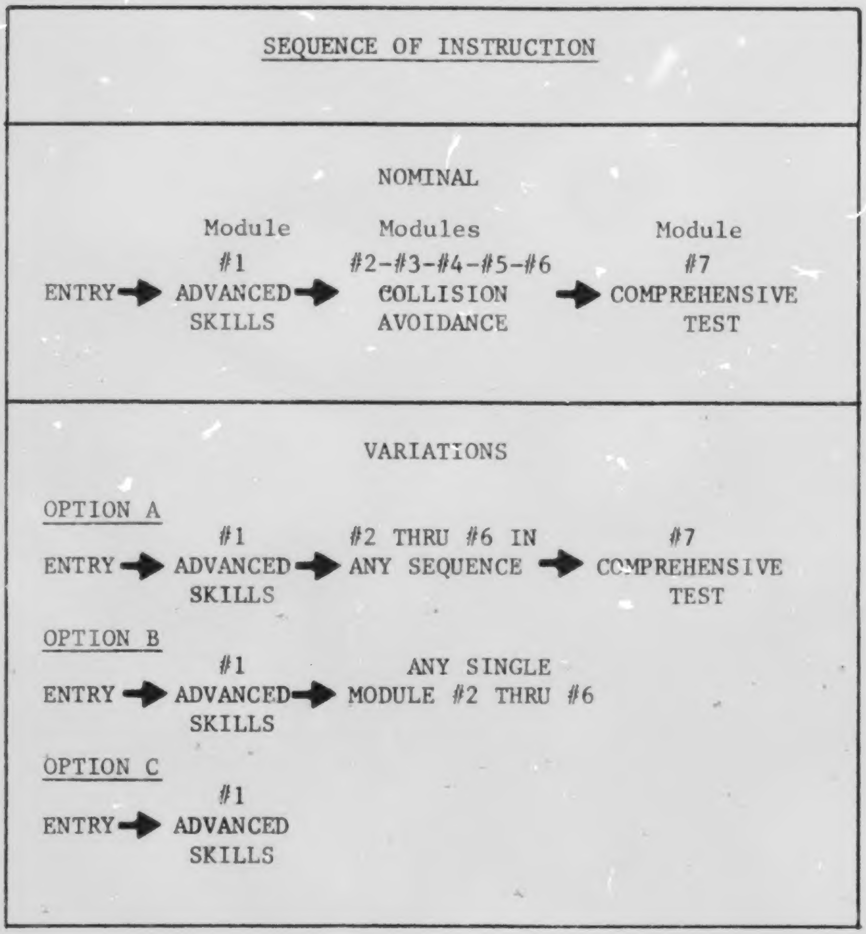

MODULE BEGINS
A
LECTURE
B
DEMON-
STRATION
C
PRACTICE
D
TEST
E
DEMON-
STRATION
SUBMODULE
SUBMODULE
SUBMODULE
SUBMODULE
SUBMODULE
UNIT OF INSTRUC-TION
UNIT OF INSTRUCTION
UNIT OF INSTRUC-TION
MODULE CONTINUES WITH DEMONSTRATION, PRACTICE, TEST SUBMODULES UNTIL ALL TRAINING CONDITIONS FOR THIS MODULE HAVE BEEN COVERED

FIGURE 3-3: FLEXIBILITY OF INSTRUCTION SEQUENCE AND LENGTH


SEQUENCE OF INSTRUCTION
NOMINAL
Module
Modules
Module
#1
#2-#3-#4-#5-#6
#7
ENTRY
ADVANCED
SKILLS
COLLISION
AVOIDANCE
COMPREHENSIVE
TEST
VARIATIONS
OPTION A
ENTRY
#1
ADVANCED
SKILLS
#2 THRU #6 IN
ANY SEQUENCE
#7
COMPREHENSIVE
TEST
OPTION B
ENTRY
#1
ADVANCED
SKILLS
ANY SINGLE
MODULE #2 THRU #6
OPTION C
ENTRY
#1
ADVANCED
SKILLS

data analysis performed for URS/Matrix and NHTSA. Likewise, the five conflict situations to be presented to students are based on the conflict situations defined by IU during the same study. Actually teaching the execution of successful strategies will be accomplished by the use of three techniques:

- classroom instruction
- simulation practice
- driving range practice

Classroom instruction will be used solelyto impart knowledge and to establish in the student the proper subconscious "set" considered requisite to the subsequent acquisition of vital perceptual, decision making and operational skills. These are the skills needed to nullify the basic conflict types postulated by Indiana University. After classroom instruction, both simulation and range driving practice will be used to extend and internalize the knowledge already gained, in order to develop the three vital skills.

Perceptual skills have sensory and cognitive components. Hence, both components must be developed if the driver being trained is to be able to detect and recognize the presence of conflict. To accomplish that, a bimodal driving simulation and two independent levels of range-driving practice sessions will be used. During "Beginning Driving Range" sessions, the student will learn basic evasive maneuvering and single-vehicle accident avoidance skills. During those sessions using the bimodal driving simulator and the "Advanced Driving Range", the student will learn to nullify multi-vehicle conflicts.

For multi-vehicle conflict situations, the student will first be subjected to equipment familiarization sessions and conflict nullification training in the bimodal simulator (See section 3.3). To "drive" this simulator, the student will sit behind the normal vehicle controls: a steering wheel, a brake pedal and an accelerator pedal. There he will get the visual feel of entering various conflict situations by attending to a film presentation of various traffic conflicts (mode #1). While watching mode #1, the student will not be able to exercise any control over the visual image. At the point in the unfolding conflict where student control is desired, the movie presentation will be terminated and the second mode, in the form of a CRT display, will be activated. On the television screen, before the student, will be presented a dynamic plan view of a roadway complete with obstacles, traffic and the student car. It will be the student's task to drive his car down the road using the vehicle controls provided to negate any conflict he encounters. As he does that, his "vehicle" will respond both in kind and in magnitude to the control inputs made.

Although the bimodal simulation lacks one-to-one perceptual realism, through its use, student drivers should learn:

- To recongize some of the significant perceptual antecedents to conflict situations (film)
- To perceive and extrapolate the relative locations of other objects (including objects that are moving) with respect to an object under this control (CRT)
- To select and execute appropriate evasive maneuvers based upon acquired visual data (CRT)

It has already been noted that two kinds of range driving practice sessions will be employed to develop perceptual skills. These will provide the student his first interaction with perceptual realism. Descriptively, they will include practicing of basic vehicle maneuvers (e.g., skid recovery, slalom exercises, lane switching, etc.) and of executing complex accident avoidance strategies. The initial sessions will be called beginning range practice, and the perceptual skills learned will contribute to the driver's ability to track the orientation of his vehicle with respect to the full-scale surrounding static environment. In the case of advanced range practice, the student will be developing the perceptual skills necessary to track the orientation of his car with respect to both fixed and dynamic obstacles in a full-scale driving environment.

In developing operational skills, both the simulation and the range practice techniques will make contributions. Because the bimodal simulation does provide the driver some limited experience in altering his "vehicle" path by kind and degree in response to simulated conflicts, he can be expected to develop some rudimentary skills in applying modulated vehicle control inputs. Then, during the more realistic range sessions, the rudimentary skills gained during the bimodal simulation practice should be forged into operational skills that are more useful in an actual driving environment.

During the beginning range practice, the training driver will develop an ability to modulate his vehicle control inputs during extreme maneuvers. These will allow him to maintain or regain the safe orientation of his car with respect to a static environment. Then, during the advanced range practice, when the student executes accident avoidance strategies, he will learn to integrate the simple operational skills already learned into effective complex control scenarios appropriate to the dynamic threats he is facing.

As the student is developing perceptual and operational skills through simulation and range practice, he will also be developing his decision-making skills. Here the bimodal simulation and advanced range practice sessions will prove most beneficial. Both of these training techniques place the student in multi-moving body conflicts. Hence, the student must sample and integrate a complex array of perceptual data. As he does that, he must extrapolate the positions of all moving bodies with respect to the fixed environment, call up knowledge of his car's maneuvering capability and decide upon the appropriate control inputs. This must be done repeatedly until the faced conflict is nullified.

Of course, the decision making process for the beginning range practice is the same as the one just described for the advanced sessions. But, in the case of the less complicated beginning practice, the student's car is the only moving body and, there is not the density of perceptual data to be processed that exists in the advanced practice.

Now all three of the teaching techniques and their relative general roles in developing knowledge, perceptual skills, operational skills and decision making skills have been discussed. Therefore, it is appropriate to turn to presenting the course structure. This will be done in terms of units of instruction.

Each of the available techniques will be administered to train drivers to overcome one of the five postulated conflict situations. Therefore, each of the conflict situations will be addressed in a single unit of instruction or training module. To these five conflict-related training modules will be added two more. One will provide students with a general course orientation and basic evasive maneuvering driving skills. The other module will consist of an integrated, comprehensive test covering all conflicts and maneuvers. Thus, the training course will contain the following seven modules:

Module 1 - Orientation and General Advanced Driver Skills

Module 2 - Collision Avoidance; Avoid being struck by intersecting vehicle.

Module 3 - Collision Avoidance; Avoid striking an intersecting vehicle.

Module 4 - Collision Avoidance; Avoid being struck by following vehicle.

Module 5 - Collision Avoidance; Avoid striking lead vehicle.

Module 6 - Collision Avoidance; Avoid head-on collision with oncoming vehicle.

Module 7 - Comprehensive Collision Avoidance Test.

3.3 SIMULATOR DEFINITION AND DEVELOPMENT

3.3.1 Background

At the conclusion of Phase I, two factors had a major impact on the subsequent project thrust: The harmonious and utilitarian nature of the accident taxonomies generated by Indiana University (IU) and Central Missouri State University (CMSU); and, the demonstration that traditional two-dimensional film presentations would not suffice to develop the neccessary driver perceptual skills. By integrating the IU and the CMSU taxonomies, five basic accident types were identified that accounted for nearly 90% of the two car collisions investigated. These included:

- Intersecting vehicle, subject struck,
- Intersecting vehicle, subject strikes,
- Following vehicle, subject struck,
- Lead vehicle, subject strikes; and,
- On-coming vehicle, head on.

Because these five accident categories are ideally suited to define units of instruction, as described in the preceding section, the primary objective of the course to be developed and tested was to train drivers (students) to nullify each of the conflicts just listed. However, with simulations based on film presentations found lacking during Phase I, selecting an appropriate alternative means to accomplish the stated program objective was a problem.

3.3.2 Requirements Definition

URS/Matrix scientists postulated that, to be effective, any approach selected would have to equip the student drivers to:

- Predict the specific point of impact of the two vehicles,
- Determine viable roadway and roadside vehicle placement alternatives,

- Select an appropriate conflict nullification strategy; and,
- Execute the strategy selected.

From prior and ongoing searches through the literature, the only experience known by URS/Matrix researchers to be really effective in developing the needed skills in most of these four task areas was "real world" exposure. However, the natural frequency of individual drivers' exposure to these conflicts is normally too low to develop the nullification skills needed. Moreover, during this program, we could not expose students to such hazards in order for them to gain experience. As a consequence, with the "real world" option eliminated, a further literature search was made to identify a previously used technique that might provide a sufficiently realistic practice environment. Many of the simulation and driving range practice techniques reported were extremely realistic, in some respects. Unfortunately, none of them provided the needed combination of interactiveness and one-to-one perceptual fidelity. A training technique had to be defined that would provide these two qualities. Since "real world" driving provided them, the question to be answered became "how can we safely replicate real world traffic conflicts between a car under the control of a (student) driver and some other car (not under student control)?"

In attempting to answer this question, a technically feasible method was defined which would utilize so-called "surrogate vehicles" on the Advanced Driving Range. Unfortunately, project resources were too limited to undertake development of the needed materials. (A discussion of the concept however is presented in Section 3.4).

Turning again to simulation possibilities, it was hypothesized that there might be a primary, trainable key skill required to nullify multi-vehicle conflicts that was not being addressed in existing training programs. Further, to be useful in simulation, the "key skill" must either not be dependent on those characteristics of existing methods of film simulation found to be unsatisfactory, or some other means of simulation must be found. Further evaluation of the accident, task, and behavioral analyses of Phase I increased even further the importance of the "perception of danger" conclusion of the Indiana University study. Regardless of any other evasive driving skills the driver might have, if the driver did not recognize the existence of an impending collision, avoiding that collision was not possible. Placed in a training context, for the training of conflict nullification skills to be feasible, students would have to learn to recognize the existence and the nature of an impending collision. This, in turn, would require the ability to extrapolate the velocities of the involved cars (i.e., the student's own car and the other cars) and predict the point of impact. Thus, it seemed logical to conclude that the better a student could perform the task of predicting the impact point, the more likely it would be that he could be trained to select an effective crash avoidance strategy. The identification of a way to develop driver velocity extrapolation skills and to train the driver to select appropriate evasive maneuvers (the first and third of the four primary conflict nullification tasks listed earlier in this section) became the principal focus of this portion of the study.

3.3.3 Concept Definition

Identification of velocity (path and speed) extrapolation skills as the key to collision avoidance training did not eliminate the need for student participation in some form of interactive crash avoidance practice. Nevertheless, by changing the training emphasis to develop specific but limited skills, one important benefit was harvested: the need for realistic perceptual cues was greatly diminished. Now, all that would be required was a display that accurately communicated to the student the velocity of two cars. One of the cars on that display would have to be under the student's direct control. The other would be controlled by the instructor. Earlier experience indicated that the reality approach to generating such a visual presentation was not achievable. Also unacceptable were most film presentations and other two-dimensional perspective view generators, because of inherent velocity distortion characteristics. These factors resulted in the identification of the need for a two-dimensional plan view, interactive trainer. Using such a trainer would virtually assure that the velocity components were faithfully communicated to students. Hence, only the transferability of trainer-gained skills to the "real world" situations remained in question. Even though a definitive answer to the transferability question will have to wait for future research, a quick look at the existing psychophysical perceptual constancy literature tends to support the use of a plan view trainer.

Three primary means of providing the needed plan view trainer were considered feasible: (1) the use of a local computer graphics terminal; (2) the use of some other, yet to be identified, existing simulator; and (3) the assembly of a simulator designed specifically for the purpose. During Phase II, cost and the time that would be required to implement the first two options were the significant factors that lead to the decision to construct a special purpose trainer. That decision, in turn, led directly to the design and construction of the "bimodal simulator".

3.3.4 Bimodal Simulator

Early concepts of the bimodal simulator depended upon a movie screen and a Cathode Ray Tube (CRT) to present two distinctly different kinds of displays. First, through-the-windshield movies of the roadway scene and the events immediately preceeding one of the five previously defined crash scenarios were to be projected on a display screen immediately in front of the driver. This portion of the simulation was only to be used during the early training trials and was intended to serve two primary purposes. First, the movie presentation was supposed to impart a "feel" to the student for the perceptual antecedents of collisions, and, second, to "set" the students for the impending interactive session. No subject control over the unfolding events being viewed could be exercised. At the point in the simulation where subject control was desired, the first (movie) presentation would be terminated and the second would be activated. This second presentation, or mode, was originally to consist of a computer generated plan view of the two "vehicles" engaged in conflict. There, the simulator was to employ the CRT display partially under student control, to provide interactive feedback to the student.

As definition of the bimodal simulator continued, a number of changes were made in the means of implementation of the concept. The movie screen has been eliminated, and a single, simplified display presents both the perspective view of the roadway scene and the plan view of the unfolding conflict situation. This display, a television screen, is installed before the subject in a "remote" driver's station (Figure 3-4), and is used during both the non-interactive and interactive portions of the training session.

DESCRIPTION: The Bimodal Simulator configuration is illustrated in Figure 3-4, and has four major subsystems:

(1) A plan-view generator for simulating the traffic conflicts;

(2) A driver control station;

(3) An instructor control station;

(4) A video system.

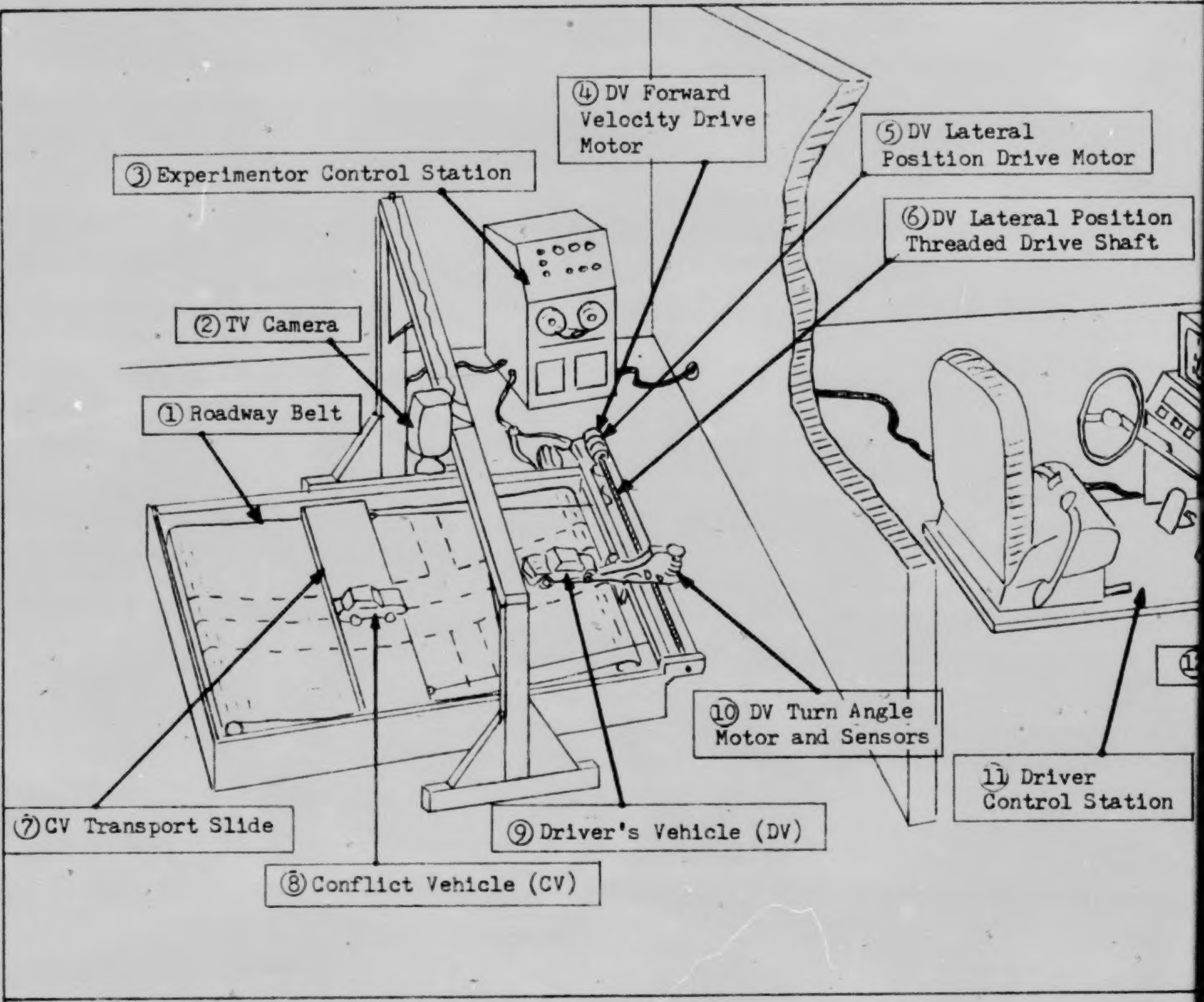
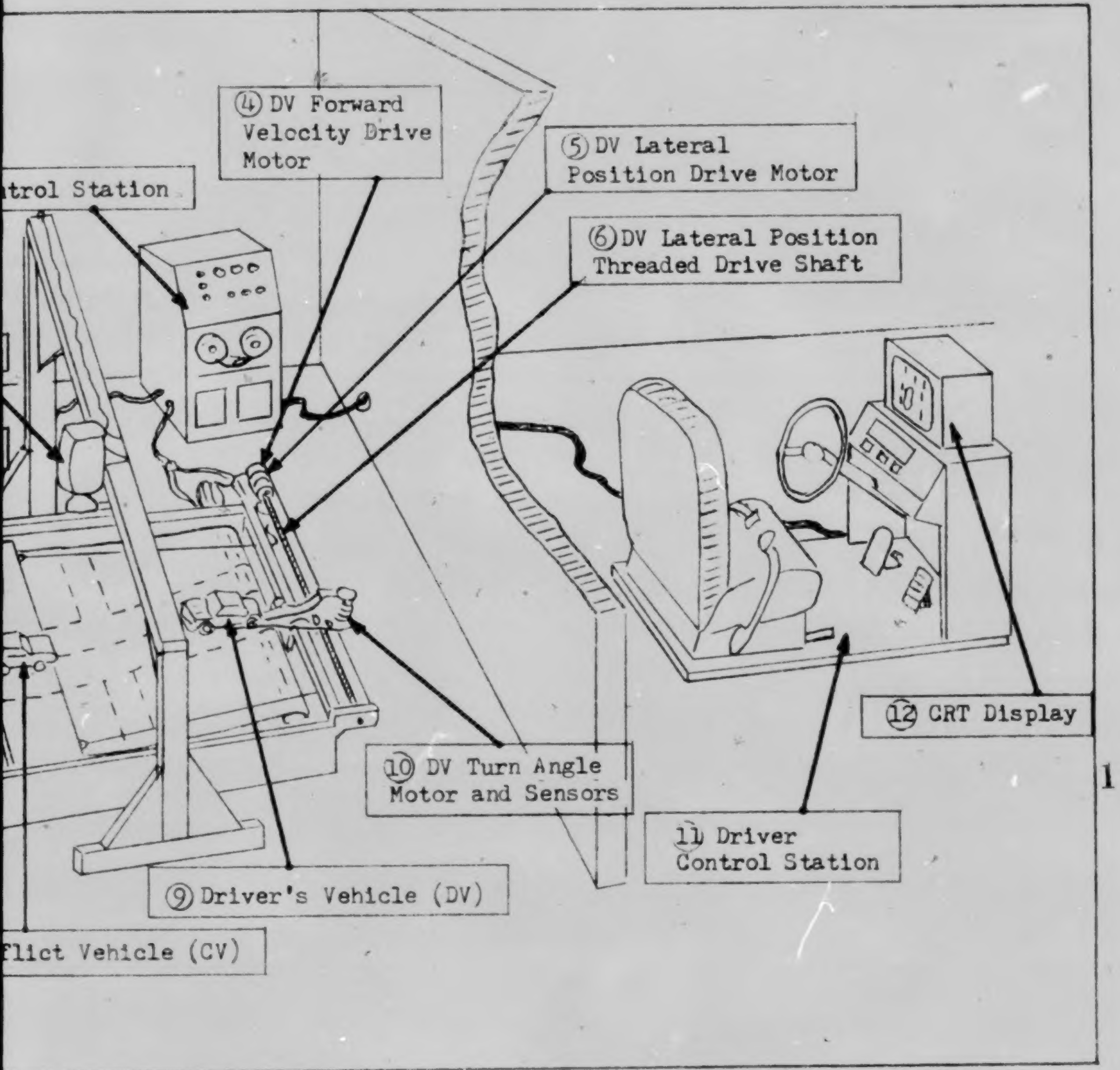

③ Experimentor Control Station
④ DV Forward Velocity Drive Motor
⑤ DV Lateral Position Drive Motor
⑥ DV Lateral Position Threaded Drive Shaft
② TV Camera
① Roadway Belt
⑩ DV Turn Angle Motor and Sensors
⑪ Driver Control Station
⑦ CV Transport Slide
⑨ Driver's Vehicle (DV)
⑧ Conflict Vehicle (CV)

Figure 3-4: Bimodal Simulator Operational Layout.


④ DV Forward Velocity Drive Motor
⑤ DV Lateral Position Drive Motor
trol Station
⑥ DV Lateral Position Threaded Drive Shaft
⑫ CRT Display
⑩ DV Turn Angle Motor and Sensors
⑪ Driver Control Station
⑨ Driver's Vehicle (DV)
flict Vehicle (CV)

igure 3-4: Bimodal Simulator Operational Layout.

The video portion of the system has the following primary components:

- Closed Circuit TV (CCTV) Camera (Panasonic WV-3082).
- Video Tape Recorder (VTR) (Panasonic NV-3082).
- 9-inch TV Screen (Panasonic TR-910VN).

Video tapes having pre-recorded sequences of the filmed perspective view conflicts spaced at 15-second intervals are used in both the interactive and non-interactive portions of the training session. The sequence begins with the prerecorded segments by having the training instructor depress the play switch on the VTR. When the subject's interactive participation is to begin, the instructor depresses the VTR's record controls and activates the plan view generator. Thus, not only is the plan view of a particular developing conflict presented to the student via the TV camera, the VTR and the CRT, but the vehicle movement activity taking place on the generator during each learning trial is recorded for future reference, analysis and student feedback.

While a detailed description of the bimodal simulator is too complex to warrant inclusion in this discussion, a schematic diagram of its configuration and photographs of the device are included in Appendix C. The operating characteristics of the bimodal simulator can best be understood by referring to that schematic, the functional flow diagram in Figure 3-5, and the examples which follow.

OPERATING AND CONFIGURATION CHARACTERISTICS: In the following descriptive examples, the two vehicles in conflict are identified as:

- Driver's Vehicle (DV) - The vehicle which the student driver controls during collision avoidance training.
- Conflict Vehicle (CV) - The vehicle with which the DV is in conflict.

Figure 3-5 shows the brake pedal and the accelerator pedal operating a single center-tapped potentiometer. That characteristic was specified intentionally to insure that when those two controls are in the null position (no driver input) the plan view generator automatically affects a DV velocity of 35 scale MPH. This latter characteristic, in turn, is a requirement to assure that the scheduled conflict results in a precisely defined accident, barring any subject control input. To accomplish these design characteristics, the brake/accelerator pot determines what signal will be sent on to the steering control. There another center-tapped pot is positioned by the control input made by the student. If there is no steering input, then no signal is sent on to the DV angle position

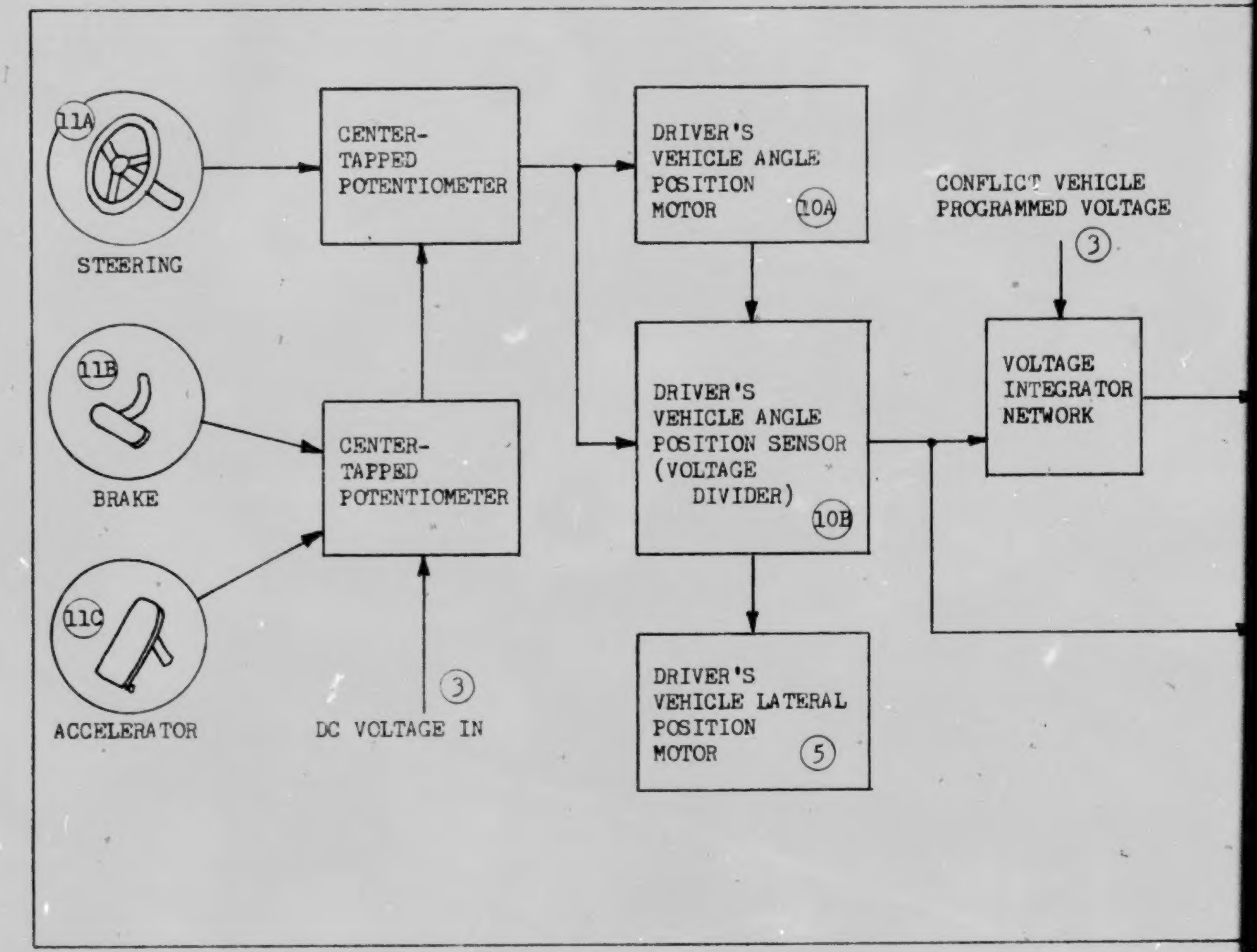
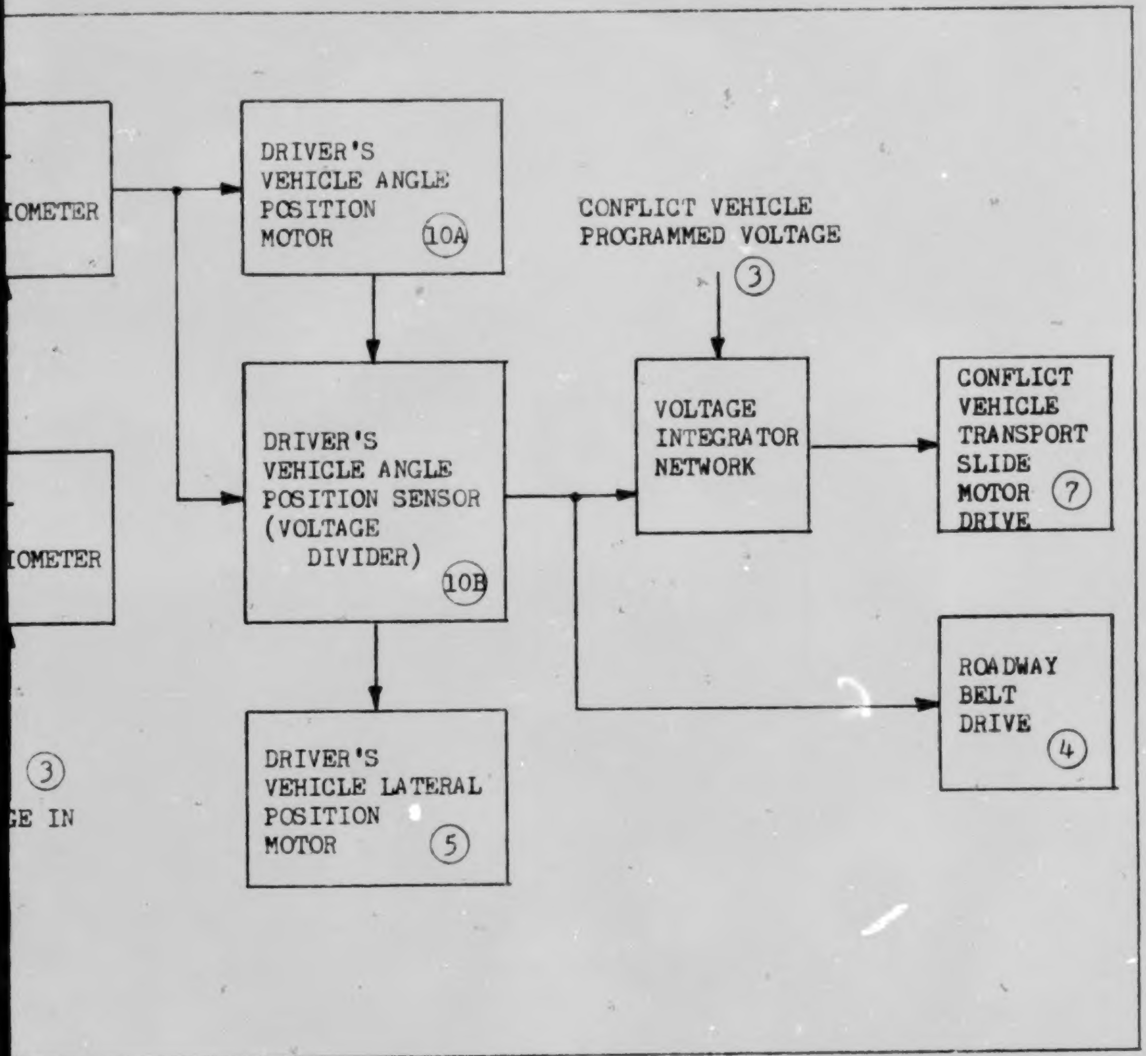

11A
STEERING
11B
BRAKE
11C
ACCELERATOR
CENTER-TAPPED POTENTIOMETER
CENTER-TAPPED POTENTIOMETER
3
DC VOLTAGE IN
DRIVER'S VEHICLE ANGLE POSITION MOTOR
10A
DRIVER'S VEHICLE ANGLE POSITION SENSOR (VOLTAGE DIVIDER)
10B
DRIVER'S VEHICLE LATERAL POSITION MOTOR
5
CONFLICT VEHICLE PROGRAMMED VOLTAGE
3
VOLTAGE INTEGRATOR NETWORK

Figure 3-5: Bimodal Simulator Plan View Generator Functional Flow.


IOMETER
IOMETER
3
GE IN
DRIVER'S VEHICLE ANGLE POSITION MOTOR 10A
DRIVER'S VEHICLE ANGLE POSITION SENSOR (VOLTAGE DIVIDER) 10B
DRIVER'S VEHICLE LATERAL POSITION MOTOR 5
CONFLICT VEHICLE PROGRAMMED VOLTAGE 3
VOLTAGE INTEGRATOR NETWORK
CONFLICT VEHICLE TRANSPORT SLIDE MOTOR DRIVE 7
ROADWAY BELT DRIVE 4

Bimodal Simulator Plan View Generator Functional Flow.

motor (10A) *. If this is the case, the DV angle position sensor (10B) sends the full value of the accelerator/brake pot signal on to the voltage integrator/resolver network as well as to the DV roadway belt ① motor. If no conflict vehicle (CV) ⑧ is sharing the plan view generator roadway ①, then the same signal is also forwarded to the CV transport slide ⑦ drive motor. Thus, if the subject makes no control inputs and no active CV condition is introduced into the simulator, the DV ⑨ is pointed straight ahead and the DV roadway belt ① and CV transport slide ⑦ (with no car placed on it or a "parked" or "stopped" car on it) move together toward the DV at a scale speed of 35 MPH. At this point, it is appropriate to describe the respective functions of the DV roadway belt ① and the CV transport slide ⑦.

The CV transport slide ⑦ is the DV and CV velocity resolver. When a CV is introduced, it is placed directly on the clear piece of plexiglass that is the CV transport slide. (The transparent slide is not visible on the TV screen ⑫.) If the CV and the DV are scheduled to move in the same direction and at the same speed, then the CV transport slide does not move. However, if the DV is to travel along a parallel axis at a different velocity, then the CV transport slide will move the CV toward (backward) or away from (forward) the DV at the appropriate differential scale velocity. If the problem being presented to the student is an intersecting vehicle conflict, the CV transport slide advances toward the DV at a rate equal to the forward component of the DV ordered velocity. In this case, the CV forward velocity is supplied by a "pull string" mechanism (Figure 3-7). To ensure a homogenious and highly regulated CV velocity during intersecting vehicle conflicts, the CV is connected to a weighted leader assembly, which, in turn, is arranged to fall through a tube ⑬ filled with Hi point silicone motorcycle front fork fluid when the conflict is initiated.

The DV roadway belt ① will always travel toward the DV ⑨ at the forward (with respect to the plan view generator's axis) vector of the subject's ordered velocity. Its use is to present the geometrical, movement and obstructional aspects of the roadway, in plan view.

Now that the functions of the CV transport slide and the DV roadway belt in administering relative vehicle velocity have been described, the mechanisms behind the movements will be discussed.

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*Circled numbers e.g., ⑩ identify the appropriate component in Figures 3-4, 3-5, 3-6 and 3-7.

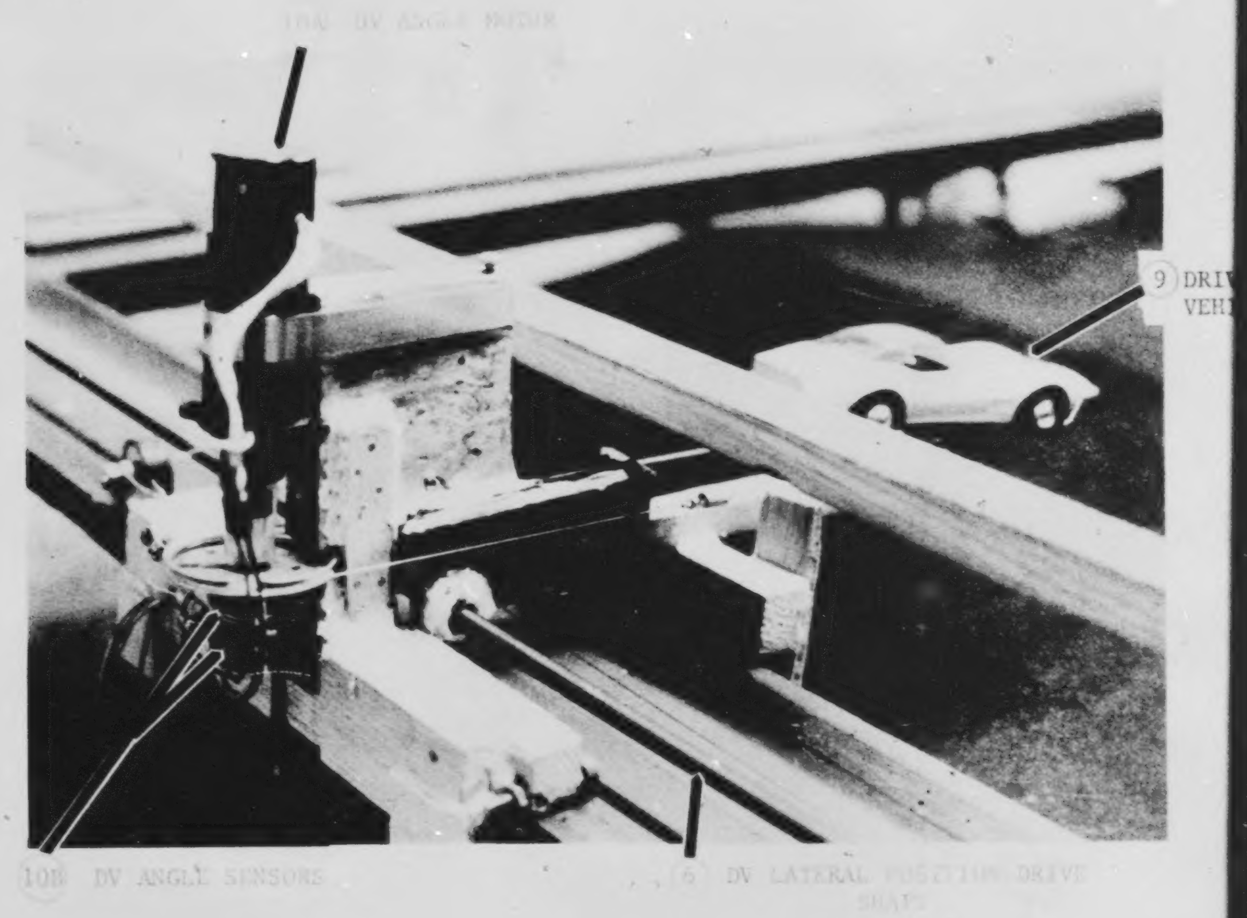
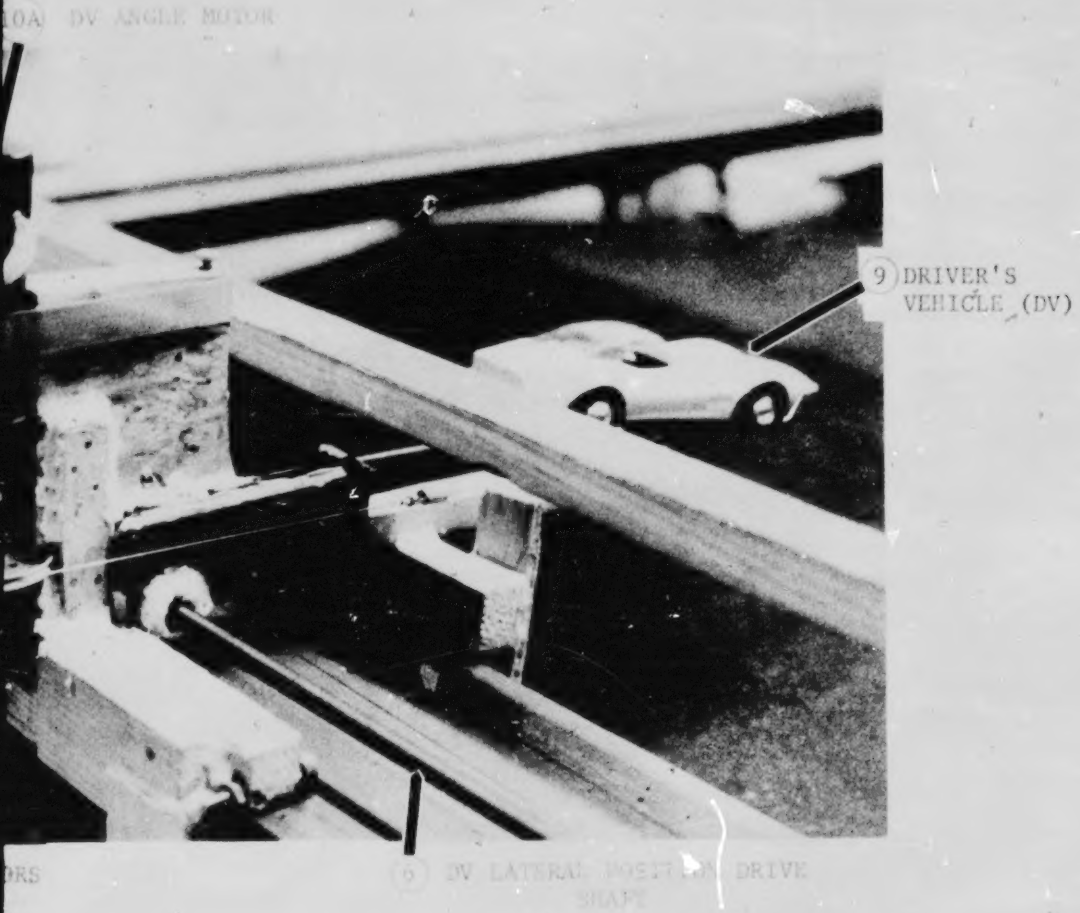
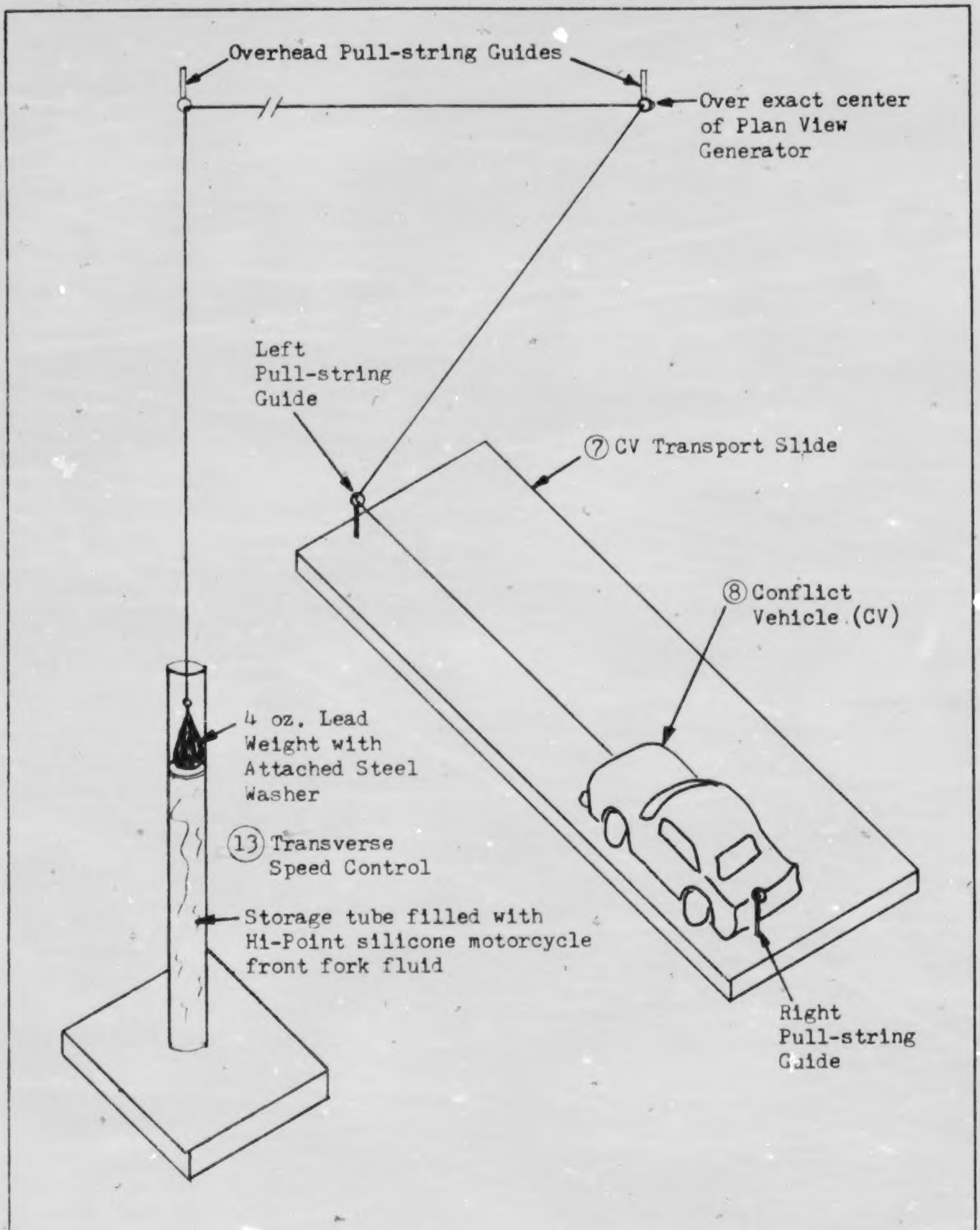

(10A) DV ANGLE MOTOR
⑨ DRIV
VEHI
(10B) DV ANGLE SENSORS
⑥ DV LATERAL POSITION DRIVE
SHAFT

FIGURE 3-6: DRIVER'S VEHICLE (DV) ANGULAR AND LATERAL POSITIONING SYSTEM


10A DV ANGLE MOTOR
9 DRIVER'S VEHICLE (DV)
ORS
6 DV LATERAL POSITION DRIVE SHAFT

VER'S VEHICLE (DV) ANGULAR AND LATERAL POSITIONING SYSTEM

Figure 3-7: Conflict Vehicle Transverse Speed Control Mechanism.


Overhead Pull-string Guides
Over exact center of Plan View Generator
Left Pull-string Guide
⑦ CV Transport Slide
⑧ Conflict Vehicle (CV)
4 oz. Lead Weight with Attached Steel Washer
⑬ Transverse Speed Control
Storage tube filled with Hi-Point silicone motorcycle front fork fluid
Right Pull-string Guide

If the subject imparts any steering control to his vehicle (DV), an associated voltage is sent to the DV angle position motor. That motor, in turn, begins to change the angle of the DV with respect to the longitudinal axis of the roadway belt. This change is at a rate proportional to the angle of the steering wheel as well as to the position of the accelerator and brake pedals. As the DV changes its angular orientation, the angle position sensor (mechanically coupled to the DV position shaft) drives the accelerator/brake pot output voltage according to the sin and the cosine of the car's angle. These two signals are distributed as follows:

One signal (sin θ) is sent to a voltage integration network as well as to the DV roadway belt drive motor. Hence, together with a voltage equivalent to an ordered CV velocity (toward or away from the DV), the first signal is resolved to co-determine the velocity of the CV transport slide. It is also used directly as the sole determinant of the DV roadway belt's velocity.

The remaining signal (cos θ) is sent to the DV lateral drive motor where it effects the DV lateral translation rate and direction.

In the manner just described, the electromechanical plan view conflict generator being used is capable of "moving" the DV along subject-ordered paths at subject-chosen rates of speed. Further, by internal mechanisms, it is capable of incorporating the movements of a conflict vehicle (CV) if that latter vehicle is to move parallel to the generator's longitudinal axis. As has already been reported, when a CV velocity perpendicular to the generator's longitudinal axis is required (intersecting vehicle conflict) a separate fluid-mechanical device is employed to provide it. CV paths other than those parallel or perpendicular to the generator's longitudinal axis are not presently incorporated. Of course, adding the capability to present the driving subject with oblique CV conflicts is a simple technical exercise. But, because no such capability was required within this contract's scope, the expense of providing it was deferred.

3.3.5 Roadway and Roadside Obstruction Awareness Development Simulation

Of the four driving tasks listed in section 3.3.2 that are related to accident avoidance during critical conflicts, two will be accommodated through the use of the bimodal simulator just described. That is to say, the skills needed by drivers to perform numbers one and three of those tasks will be developed through the use of the bimodal simulator during the training program discussed in section 3.2. In addition, task number four (execute the strategy selected) should be readily within the performance capability of students who have completed module number one of the training program (Orientation and General Advanced Driving Skills). Only the accommodation of driver task 2 ("determine viable roadway and roadside vehicle placement alternatives") has yet to be addressed.

When Phase II began, plans for developing lane occupancy and roadway obstruction awareness skills needed to accomplish task 2 were limited to subjecting students to lectures, films and paper tests. That was because, then, the major program emphasis was on developing intra-conflict collision nullification skills. The criticality of lane occupancy awareness skills was certainly recognized, reflected in the fact that each conflict situation to be practiced did incorporate trials that included lane occupancy and obstruction conditions. Little thought had been given, however, to preparing an effective methodology for overtly developing and measuring roadway occupancy awareness in the driver. Now it is recognized that if this training program is to attain the hoped for success, it must not leave the development of skills essential to providing that awareness to chance. In fact, the training program must correct any major deficiencies in obstruction awareness skills.

The importance of these skills is readily apparent when one considers that the driver facing an imminent collision may not have time for "one last look around". Thus, he must learn to continuously log into his conscious and subconscious mind the important characteristics of his changing immediate extravehicular environment. While he is developing the skills to do that, the driver must also learn to extrapolate the data acquired during his visual scans. Moreover, he must learn to extrapolate sufficiently well to predict the roadway occupancy status between looks with utilitarian accuracy. For these reasons, URS/Matrix recommends that a technique be selected to purposefully equip students to perform conflict nullification task 2. In addition, it is recommended that whatever technique is selected for that purpose include:

- In-class lectures to acquaint students with effective visual search schemes to detect and recognize important extravehicular environmental characteristics; and,
- Behind-the-wheel practice sessions in a training vehicle or simulator to

to develop effective awareness acquisition skills by internalizing the points covered in lecture.

3.4 ADVANCED DRIVING RANGE

The concept of an Advanced Driving Range (ADR) has been previously mentioned as a potential solution to the need for collision avoidance training to be as "real" as possible. The basis for this requirement for reality was that only with the student being confronted with a real (or seemingly real) impending collision could the perceptual, cognitive, and operational skills needed for reflexive accident avoidance behavior be developed. The alternatives which appeared to be available to satisfy this need were:

(1) Conduct training in real vehicles in real traffic conflict situations. This approach was rejected for obvious reasons of student, instructor and bystander safety, astronomically high property damage costs, and an inability to control the frequency or the characteristics of the traffic conflict.

(2) Conduct training in real vehicles on a closed driving range. While this approach does allow control of the training situation, the safety and cost factors would not be sufficiently ameliorated to be practical, leading to its rejection as well.

(3) Conduct training in a high-fidelity, six-degree of freedom simulator in which all real-world parameters are faithfully reproduced. Such simulators can be built, as we know from the experiences of NASA and the U.S. Air Force in training of astronauts and pilots, respectively, but at very great expense. Even with the financial resources which have supported the development of such simulators, however, they are still subject to severe criticism regarding inadequacies in simulating real situations.(15) Assuming, however, that such a simulator could be built that satisfied all the perceptual and motor requirements, the costs of manufacturing them in sufficient quantities - and with the associated facility

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(15) Hopkins, C.O., "How Much Should You Pay For That Box?", Human Factors, Vol. 17 (6), December 1975.

and computer support requirements - to make them available for training of the general driving population nationwide resulted in the dismissal of this alternative as being totally impractical.

(4) Conduct training in some other way which faithfully reproduced the significant psychomotor parameters, reduced the hazards to an acceptable level, was amenable to training staff control, and could be accomplished at a reasonable cost. This alternative was selected to be defined further, as the "Advanced Driving Range" (ADR) concept.

ADR CONCEPT DEFINITION: To meet the requirements stated in alternative (4), above, the project staff defined the following characteristics of the ADR training concept. Collision avoidance training would be conducted on an automobile driving range from which pedestrian and other motor vehicle traffic can be eliminated, and which has few, if any, surface obstructions. Such facilities already exist in many parts of the country and, where they do not exist, the major acquisition cost is for open land. Even this cost can be reduced by locating suitable, existing roadways and closing them to traffic while training is in progress. In this concept, the student driver will operate a standard automobile, either compact or midsize. Automobiles currently in use for driver education would be entirely suitable. The final requirement (a controlled, safe, real collision situation) can be satisfied by providing a very low mass, remotely controlled "surrogate vehicle" in a real vehicle size. This surrogate vehicle is the key to the ADR concept, and fills the role of the conflict vehicle discussed in the section on the bimodal simulator.

As visualized by URS/Matrix, the surrogate vehicle should approximate the size, shape and appearance of a typical subcompact car. Yet, in meeting these requirements, it must present little in the way of hazard to student drivers and it must be damage resistant to full sized auto impact. Finally, it must be able to execute a pre-established series of maneuvers at the discretion of the training instructor. For practical purposes, this solution provided, safely, all the same training advantages as the "real world" conflict. That is, such a vehicle could be used to engage the student in those conflicts identified during Phase I. Moreover, while engaged in those conflicts, the experience would be interactively and perceptually real. The student driver could actually crash into the other car without sustaining injury or inflicting property damage, if he was not successful in nullifying the presented conflict. It seemed to be a very satisfactory solution. There was only one problem; developing the surrogate vehicle or any similar device was definitely beyond the funding levels of the contract.

Nevertheless, URS/Matrix did define and incorporate ADR training as a key element in its overall program because this kind of training most nearly replicates real world experience. In fact, except for not eliciting the same degree of subject-perceived risk and a debilitating startle response, the ADR experience will be precisely real. Thus, from a face validity standpoint, an ADR training program provides the most attractive means possible for answering what is perhaps this project's most important research question: "Is it feasible to develop an effective accident avoidance training program for critical conflict situations?" Because this is the case, the ADR practice exercises that should be employed have already been defined in the curriculum specification discussed in section 3.1. The majority of any future ADR work should be directed toward preparing instructional materials, supplying appropriate program support equipment and providing operational surrogate vehicles.

URS/Matrix strongly recommends that continuation of the work begun during this contract include the development and use of what we have labeled ADR training.

3.5 CONCLUSIONS AND RECOMMENDATIONS - PHASE II

Phase II had the objective of planning and developing the procedures and materials needed for conduct of an accident avoidance skill training program, testing those procedures and materials with a group of student drivers, and preparing a plan for an operational evaluation of the training program. While it must be recognized that the program fell short of the original goals, the achievements were substantial and, in the opinion of the authors, will outweigh the deficiencies in the long term.

The principal products of Phase II were:

(1) Verification that the accident conflict and maneuver taxonomies developed during Phase I can form the basis of a collision avoidance skill training program.

(2) Development of a comprehensive Curriculum and Performance Measurement specification which is both sufficiently detailed and flexible to permit completion of the training program development and adaptation according to local needs and resources.

(3) Definition, development, and preliminary testing of a "bimodal simulator" which can be used for training drivers in key collision avoidance skills.

(4) Definition of a method for in-vehicle training in collision avoidance techniques which satisfies requirements for safety, reality, low cost and training staff situation control - the Advanced Driving Range concept.

(5) Identification of many, and resolution of a few, research problems which must be addressed before an accident avoidance skill training program can become a reality. The outstanding research considerations are identified and briefly discussed in Section 4.0.

The principal conclusion which was reached during this program is that accident avoidance skill training is necessary, is feasible, and can be accomplished at a reasonable cost. The products of this study, in both Phases I and II, are believed to provide the basis for continuation of this development program area under the continuing sponsorship of the NHTSA. Any such continued effort should address some, if not all, of the outstanding research issues described in Section 4.0.

4.0 FUTURE RESEARCH AND DEVELOPMENT REQUIREMENTS

4.1 PROGRAM COMPLETION

The preceding pages of this report have documented the accomplishments and findings of Phase I and II of the Accident Avoidance Skill Training Program. Evidence has been presented that indicates that training in collision avoidance techniques is feasible and may be cost-effective as well. In terms of future NHTSA support of this program area then, the primary recommendation to be made is that the program be carried through to completion. This entails the following major activities:

(1) Completion of the developmental evaluation of Accident Avoidance Skill Training (AAST) methodology which was initiated and developed during Phase II of the project.

(2) Resolution of the significant, outstanding research problems and issues which have been identified during the course of this program (see section 4.2, below).

(3) Conduct of an evaluation of the training and testing procedures by training a large number of students, and evaluating their success in an operational, real-world driving setting (Phase III).

(4) Development and evaluation of training/testing materials and procedures for training of additional, more specialized groups of drivers, e.g., bus and truck drivers, emergency vehicle operators, etc. (Phase IV).

The value of each of the originally planned activities to eventual reduction in traffic conflict accidents has become more evident with the progress made to date. It must be noted, however, that the number and complexity of "unknowns" which were identified, particularly during Phase II, necessitate that attention be given to their significance and possible resolution prior to initiating Phase III. Some of these problem areas have been mentioned in the preceding pages of this project report, and all have been previously reported to the NHTSA. Since the scope of the current program did not permit attention to these problems, they should (as appropriate) be addressed prior to, or during, Phase III.

4.2 RESEARCH QUESTIONS AND PROBLEMS

At the time that the current program was initiated by NHTSA, driver education and training programs were developed mostly according to a consensus standard, i.e., by reaching general agreement among the individuals who had been in the field longest (generally regarded as the authorities on the subject). As a consequence, each "new" program became an exercise in modernizing an older program based on recommendations of authorities or by incorporating the accepted practices of others. Whether or not the result has been improved driver performance is not at issue. Of significance is the assumption, implicit in the RFP which led to this program, that little or no new research or utilization of new methodologies would be required to develop and present a valid accident avoidance skill training program. The approach was to identify the accidents to be avoided, define the maneuvers to be executed to avoid such accidents, and compile what seemed to be the best of the available materials into a suitable training program. Progress to date has made it apparent to all those involved with the program that a "cut-and-paste" approach will not provide a satisfactory training program. The conflict issues are too complex, and time must be taken to develop answers to the more significant questions if the final training package is to have reasonable validity.

A great many unknown areas and potential research topics have been identified during the course of this project. These have been distilled into the following hypotheses, each of which is discussed with respect to its significance to the objectives of this program. Those which are believed to be of greatest importance, and which are feasible for resolution within the scope of this program area are recommended for inclusion in the continuation of the program.

4.2.1 Validity of Avoidance Maneuver Gaming Decision

HYPOTHESIS: "In a critical conflict situation involving two automobiles, the driver of the vehicle with which the trained driver is in conflict will make no avoidance maneuver."

DISCUSSION: The underlying assumption, in determining what the subject driver should do in each conflict situation, is that the driver of the vehicle with which he is in conflict will make no avoidance maneuver. This premise was originally adopted since there is no absolute method of determining what the other driver will do, and the Indiana data(2)indicates that almost half (46%) of the drivers involved in a conflict realized it too late (if at all) to make any avoidance response. It was decided that the driver of the conflict vehicle will either make no evasive response, or that any response which he does make will not increase the probability or severity of the collision. Is it now appropriate to either substantiate the validity of the assumption or redefine the maneuver alternatives to account for an evasive maneuver by the other driver?

There are several compelling reasons why this ground rule was adopted. First, there is a reasonable expectation (based on the Indiana data) that less than half of the drivers involved in a multivehicle conflict situation will realize it in time to initiate any type of evasive maneuver.

Secondly, the ground rule was established because of the defined conflict time frame (1 1/2 seconds or less prior to a collision). If the driver of the other car has not already initiated a collision avoidance response, prior to 1 1/2 seconds before the crash, the chances are very slim that he will do so. Moreover, if he does manage to initiate an avoidance maneuver within that period, the probability is even slimmer that he will do it within the window (1 1/2 seconds to 3/4 seconds) that the trained driver can initiate any effective counter response.

The third reason for the "no response" ground rule is linked to the primary program purpose. That purpose is to determine the feasibility of training conflict collision avoidance skills. Since that feasibility can be adequately determined using the ground rule in question, its use is justified.

Because each one of the reasons offered constitutes ample justification for implementing the "no response" ground rule, URS believes the hypothesis is valid for the current program. Eventually, the condition may prevail when sufficiently large numbers of drivers have received training in accident avoidance skills that effective (and possibly counter productive) evasive maneuvers by both drivers are more probable. Such an eventuality should be considered in planning for Phases III and IV, to evaluate training in an operational setting. Further, it is recommended that the MDAI teams, under NHTSA sponsorship, attempt to gather more detailed data on multivehicle collisions in order to clarify the issue further.

4.2.2 Prerequisites to Advanced Driving Range (ADR) Training

HYPOTHESIS: "Training of drivers in collision avoidance skills on a driving simulator is unnecessary if they will also receive effective behind-the-wheel training."

DISCUSSION: The Accident Avoidance Skill Training (AAST) Program, as presently structured, calls for drivers to be trained in vehicles on the driving range only after they have completed training sessions in the classroom and on the simulator. This approach was specified partly due to historical precedent, and partly due to what then seemed to be the likelihood that no safe opportunity for on-range training would be available in this program. As a research issue, however, it needs to be determined whether it is feasible to omit the simulator training, and have students train on the Advanced Driving Range directly.

Assuming the satisfactory implementation of some form of behind-the-wheel collision avoidance training, there is some question about the necessity for using the bimodal simulator (BMS). Since we believe that the ADR practice will provide all of the experience elements provided by the BMS practice (and then some) we can safely surmise that, given the use of the ADR training, BMS training is not absolutely necessary. However, before plans to use the BMS are discarded, it should be recognized that its use may significantly reduce the amount of ADR training required (perhaps to zero). Thus, the BMS may prove to be a cost effective tool, a primary goal of training researchers (15). In fact, on the basis of cost effectiveness, it might conceivably be the only practice tool that can be justified. Therefore, URS recommends an effort to establish the cost effectiveness of using the BMS compared to behind-the-wheel practice as envisioned in the Advanced Driving Range (ADR) portion of the training, during the completion of the developmental evaluation.

4.2.3 Advanced Driving Range (ADR) Alternatives

HYPOTHESIS: "Behind-the-wheel driving range practice, using a "surrogate vehicle" as a conflict vehicle, is the most effective method of training drivers to acquire collision avoidance skills."

DISCUSSION: The present concept of ADR training traces from an analysis of the inadequacies and/or safety problems inherent in traditional approaches to on-range evasive training. It has been suggested that further investigation and verification of the pros and cons of these alternatives be performed prior to a firm commitment to the utilization of a "surrogate vehicle" for collision avoidance training.

The availability of alternatives to the Advanced Driving Range concept, which utilized a "surrogate" conflict vehicle, has been addressed on a number of occasions during this program. The results of an evaluation conducted earlier in the program, described in section 3.4, led to our recommendation for the Advanced Driving Range. In essence, this evaluation establishes the theoretical validity of presenting multivehicle conflicts in actual on-the-road, real world situations in order for the student to gain practice in collision avoidance skills. It was also shown, however, that such a method presents unacceptable hazards and costs for training purposes. In attempting to identify alternatives to real-world practice, driving simulators were considered, as were the techniques of using non-vehicular obstacles such as bouncing balls, cardboard cartons, etc. While each of these methods has some merit and utility, none provide the realism which, in the judgment of URS researchers, should (and could) be provided. The concept of a "surrogate vehicle" seemed to be the best compromise. Initial analyses showed that such a surrogate vehicle could be fabricated relatively inexpensively, that it could be configured to resemble another vehicle in both appearance and motion (within the critical conflict time frame), and that it would present practically no hazard to the student driver. It seemed then, as now, to be the most acceptable solution to the need for both realism and safety. There is no doubt that other methods of allowing a student to practice are available. On the basis of the analyses conducted to date, these methods are just as expensive to incorporate and less realistic. In the opinion of URS/Matrix researchers, repeating these analyses would serve no useful purpose and would certainly not be cost-effective. As a consequence, it is recommended that research be conducted to test the hypothesis based on the surrogate vehicle concept and that consideration of other approaches should be set aside until this work has been completed.

4.2.4 Conflict-Specific Maneuvers Versus General Maneuvers

HYPOTHESIS: "The almost infinitely large number of possible conflict situations requires that drivers be taught general evasive maneuvers rather than conflict-specific evasive maneuvers."

DISCUSSION: The present approach to collision avoidance training is indeed based on specific responses to specific conflict situations which, when the obstruction variables are superimposed, present a very large number of possible situation-response alternatives. Questions have been raised whether it is feasible - or practical - to train such a large number of alternative responses, whether there are a finite number of "general" maneuvers which can be derived which represent the best compromise, and whether teaching the "general" responses would be a more practical training solution. Examining the issue another way, will training of specific situation/response alternatives allow (or preclude) the driver to develop his own "general" responses, and is that desirable?

The basis of this issue is believed to be the erroneous assumption that it is intended that drivers be trained to employ some large number of specific and unique responses to an equally large number of conflict situations. While there will be a large number of conflict situations, only a limited number of responses is needed to nullify the spectrum of conflicts.

The Indiana data indicates that, now, the most prevalent collision avoidance response made is locking up the brakes. URS is simply attempting to expand the drivers' repertoire to include modulated braking, steering and accelerating responses. Effectively, these responses are only one level of complexity higher than the method currently employed. Thus, if the central question at issue ("can effective conflict collision avoidance skills be developed?") can be answered yes, it must be possible to train drivers to properly select from among the three response options indicated (or combinations thereof), based on the characteristics of the conflict situation.

The traditional approach has been to "teach" perceptual, judgmental, and motor skills - in that order - with emphasis on motor skills. The judgmental skills necessary to selecting a correct response have been equated with various decision trees, with incremental yes or no answers, and resulting "correct" responses. The recommended responses include the same three alternatives (braking, steering, accelerating) as planned for the URS program, appropriately modulated.

Of course, if modulated control inputs are to be employed, drivers must be able to descriminate what conflict they are facing. Hence, the pilot training plan is structured to find out if drivers can correlate their control responses to conflicts that are specifically defined (with respect to their closure geometry and point of impact). It is here that the "conflict-specific" nature of the URS approach is factored in. The conflicts to which the driver will be exposed will be presented both generically (e.g., intersecting vehicle), and in terms of the characteristics of that (intersecting) vehicle which dictate what the possibly successful alternatives are. This approach will ensure that the variations in exposure that are important will be presented, and not left to chance. Further, performance testing can be accomplished against the situation characteristics rather than the generic conflict. Generalizability of responses should be increased using this method since a wider spectrum of controlled situations will be presented.

In view of the foregoing, URS recommends that the hypothesis be tested using the conflict-specific approach as the basis for structuring the prototype course.

4.2.5 Perspective Versus Plan View in Simulation

HYPOTHESIS: "During simulator training, the student driver should be presented with the same view of the developing conflict situation as would be seen from the driver's seat of an automobile in a real world situation, i.e., a persepctive view."

DISCUSSION: During the interactive portion of simulator training (in the recommended scheme), the presentation to the student driver is a plan view. While there were several reasons for adopting this approach, these reasons have not yet been validated through testing. In addition, there is no specific data available regarding the transition from perspective to plan view during bimodal simulation, and from plan view to perspective view when the student driver begins behind-the-wheel training or on-road driving.

The rationale for selecting a simulator which presents the evolving conflict situation in plan view rather than perspective view is based primarily on the purpose of simulator training in this program: to train the driver to select appropriate strategies for collision avoidance. For this goal, it is important for the driver to be able to recognize the existence of a conflict, and to be provided with the visual cues for extrapolating the velocities (path and speed) of the two vehicles and predicting the point of impact. These particular features can be provided more easily and with less distortion in plan view than in perspective view. Eventually, of course, the student must apply these learned strategies in persepctive view, either through behind the wheel practice on a driving range as we have recommended, or directly through on-the-road exposure. If it is shown that simulator training (without range training) is the most practical solution to administering Accident Avoidance Skill Training (AAST) to large numbers of drivers, then the hypothesis should be tested to determine transition effectiveness.

4.2.6 Electromechanical Simulator Versus Electronic Simulator

HYPOTHESIS: "An electronic simulator, with few moving parts, is inherently more reliable and therefore preferable to an electromechanical (EM) simulator for purposes of the AAST program."

DISCUSSION: URS/Matrix researchers believe the hypothesis stated above is valid even though the "bimodal simulator" to be used in the Phase II training program is electromechanical in configuration. The question has been raised regarding the reliability of an electromechanical simulator. However, the EM version of the simulator is merely [illegible] prototype for use in the pilot program; any units for extended training should be fully electronic. The present electromechanical version was used for concept verification purposes because it could be more easily assembled, at much lower cost, and could be more easily changed according to in-process experience. Further, it is relatively easy to repair should it fail. Should the techniques of plan view simulation be shown to be cost-effective for purposes of accident avoidance training, an electronic simulator system will undoubtedly be recommended for long-term training. The state-of-the-technology is such that this system should present no difficulties in development. The initial cost factor, however, is such that it is not warranted for development in the Phase II program, and no specific effort related to that objective is recommended.

4.2.7 Other Types of Simulators

HYPOTHESIS: "The Bimodal Simulator proposed by URS/Matrix is a less effective driving simulator for AAST than other available simulation systems."

DISCUSSION: The bimodal simulator which we have recommended is recognized as being somewhat unique. Unique does not necessarily mean better.

Any time an approach to a problem is suggested, the question "is there a better way?" is a proper one. It was this process of questioning which resulted in defining the requirements for the bimodal simulator (BMS). Early in Phase II, URS performed a cursory search of the literature directed at this question. Many other alternatives were considered before deciding to use the bimodal simulator concept. As was discussed in an earlier section, the BMS provides a way to train drivers in collision avoidance strategy selection, and it could be accomplished in a cost-effective manner. Of the types of simulator systems reviewed, no other available simulator would meet those requirements.

Still, the question has been asked a sufficient number of times by other interested parties to justify further comment. A need exists to determine whether there are other simulators which can meet AAST requirements, and how they compare in effectiveness to the BMS concept. URS recommends that the validity of the above-stated hypothesis be examined in parallel with completion of the developmental evaluation.

4.2.8 Retention of Emergency Procedures Skills

HYPOTHESIS: "The collision avoidance skills which drivers must develop are too complex to be retained without frequent reinforcement of learning."

DISCUSSION: Skill retention has been considered a viable research issue since this program began. It has been recognized that even if accident avoidance skills can be learned, they may be poorly retained by drivers who have infrequent reinforcement. This is one of the reasons for planning a Phase III to the program. The problem, however, is the concern that the training to be conducted in Phase II, and eventually in Phase III, will be of little value if at the end of Phase II it is determined that the retention period for these learned complex tasks is too short to be useful. Some advance indication of the retention probability is highly desirable. It has been suggested that the complex learning task being taught is similar in many respects to emergency procedures learned by aircraft pilots, astronauts, etc., and that the aerospace literature may provide an advance indication of the success potential for this program. Consideration should also be given to the feasibility of structuring the training and testing in Phase II to provide as much information as possible regarding the retention question.

The importance of determining whether such skills can be retained has increased, and can be practically accomplished during completion of Phase II to provide some interim insight to this question.

4.2.9 Single Vehicle Accident Recovery

HYPOTHESIS: "The driver skill and performance requirements for recovery from imminent single-vehicle accidents are different from those involved in multi-vehicle collision avoidance, and are not adequately covered by the proposed seven-module AAST program."

DISCUSSION: Attempts to define the characteristics of automobile accidents have found it convenient to establish two basic categories:

(1) Accidents in which only a single motor vehicle is involved;

(2) Accidents involving two or more motor vehicles.

In the current program, the second category was emphasized inasmuch as it includes by far the largest number of accidents(2,13)with estimates of multi-vehicle accident frequency ranging from 69% to 79% of all motor vehicle accidents. A second reason was the assumption, since questioned, that in learning the advanced vehicle handling skills which are prerequisites to learning collision avoidance skills, the driver would be adequately equipped to recover from potential single-vehicle accidents.

Module #1 of the recommended training program is concerned with teaching advanced driver skills, independent of the multi-vehicle collision situation. These skills were considered important primarily because they had been identified as key components of the driver's ability to nullify multi-vehicle conflicts. The exercise programs discovered in the literature were usually structured to familiarize the driver with the relationship between his control inputs and vehicle's dynamic responses. Thus, the perceptual cue environments of these programs also tended to be structured to serve the same purpose. So while the perceptual skills developed through participation in the reported exercises might help the driver perform any of several vehicle maneuvers, they would not necessarily equip him to select an appropriate avoidance strategy when faced with an imminent collision.

In certain instances, e.g., skid control and off-road recovery, the existing curriculum addresses recovery from potential single-vehicle accidents. Even here, however, there is emphasis on the "recovery" aspect, with little or no attention to the perceptual skill necessary for strategy selection in the real world.

In view of the foregoing, two questions must be asked:

(1) How do we know that the single-vehicle skills we are teaching, and the methods to be used, are valid?

(2) Can the realm of single-vehicle accidents be characterized in the same manner (e.g., situation/response) as multi-vehicle accidents and, if so, can (and should) such accident avoidance skills be included in an Accident Avoidance Skill Training Program?

An interesting adjunct to the above considerations is the thought that if AAST is successful in reducing the number of multivehicle collisions, the portion of total accidents represented by single-vehicle accidents will dramatically increase. This could occur, in part, because of a reduction in the total accident rate without an accompanying decrease in single-vehicle accidents. Further, in two-car conflict situations, where the conflict vehicle is a "threat", it can be projected that many conflict vehicles will collide with something, even if the trained driver manages to get clear. In addition, the avoidance maneuver selected by the trained driver may result in a (less serious) single-vehicle accident, as the best alternative available.

URS/Matrix believes that the category of single-vehicle accidents (representing some 30% of all accidents) must be examined more closely, to ensure that the evolving driver training program will adquately attend to both multi-car conflict collision and single car accident avoidance skills. For maximum benefit the necessary analyses and development effort should precede initiation of Phase III.

4.2.10 Best Alternative Versus Safe Alternative

HYPOTHESIS: "Collision avoidance maneuver alternatives to be used in training drivers should be defined so that the driver remains as safe as possible even if the maneuver is not successful."

DISCUSSION: This topic has not been raised often, but it does have some critical implications. From a purely physical standpoint there is a "best" alternative response for each conflict examined so far. Hopefully, drivers can be trained to select and implement that "best" maneuver. However, considering the performance degradation (however slight) which can be expected over time, the many differences which will exist between real-life conflicts and training conflicts, (e.g., relative and actual speeds, approach angles, etc.) and the possibilities that the other driver may respond with an evasive maneuver, some of these "best" maneuvers may actually increase the probability or severity of an accident if not performed correctly. Should we still try to train the driver to make that response, or should we try to train them to perform a maneuver which is "safest" under all anticipated circumstances?

In the opinion of URS/Matrix researchers, this question cannot be resolved within the scope of this program. It involves not only legal and policy decisions on the part of NHTSA, but can not truly be addressed until all of the recommended collision avoidance techniques have been shown to be feasible for training. It is then a proper (and already identified) objective of Phase III - "Will drivers who have learned collision avoidance skills have fewer accidents?" In addition, there is evidence(16), that the "safest" alternative to evasive maneuvers is what most drivers do now, i.e., emergency braking.

Considering the implications of the foregoing, URS/Matrix recommends no new effort relative to this question until completion of Phase III.

4.2.11 Lane Availability for Steering Maneuvers

HYPOTHESIS: "Steering maneuvers should be eliminated from the collision avoidance repertoire since drivers in a critical conflict will have insufficient time to determine whether they can safely change lanes."

DISCUSSION: In each of the multi-vehicle conflict situations which we propose for training, there are response alternatives which vary according to obstructions, or maneuvering space. These alternatives are based on the premise that the driver may have time for a "quick look" (see section 2.4.3) and, that he can continuously log changes in his extravehicular environment (e.g., other vehicles in other lanes), calling up that information as needed when selecting the proper avoidance maneuver for a given situation. As implied in the hypothesis, however, drivers who suddenly implement steering maneuvers without knowing the extent of maneuvering space available to them may actually increase the probability or severity of a collision.

When Phase II began, plans for developing lane occupancy and roadway obstruction awareness skills were limited to subjecting students to lectures, films and paper tests. That was because, then, the major program emphasis was on developing intra-conflict collision nullification skills. The criticality of such awareness skills was recognized, and each conflict situation included lane occupancy and obstruction variables. Little thought had been given, however, to preparing an effective methodology for developing roadway occupancy awareness in the driver. Now, however, it is recognized that if this training program is to be successful, it must not leave the development of the skills essential to providing that awareness to chance. In fact, the training program developed must correct any major deficiencies in these skills. The importance of such awareness skills is readily apparent when it is considered that the driver, when faced with an imminent collision, will have no opportunity for conscious thought or recall of his dynamic or static surroundings. The driver is being taught to reflexly select the best choice of avoidance maneuver from the alternatives available. That choice must be based on not only the path characteristics of the conflict vehicle, but also the paths and spaces which are open to him. (For example, in an intersecting vehicle conflict with the conflict vehicle approaching from the right, the driver may execute a "steer left and brake" response. In doing so, he must know that the lane to his left is open. If another vehicle is in that lane in close proximity, the maneuver could result in a more serious accident than the one the driver was attempting to avoid.) The driver must learn to continuously log into his conscious and subconscious mind all the characteristics of his changing immediate extravehicular environment. While many drivers learn to do this as a result of their everyday driving experiences, experience can be a demanding teacher. Some drivers never learn such awareness skills until too late. An attempt must be made to determine whether such skills can be taught.

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(16) "The Evasive Action Decision in an Intersection Accident; A Game Theory Approach". Prentice, J.W.; Journal of Safety Research, Volume 6 (4), December 1974.

Doing that will require a curriculum that provides students a basic knowledge of effective awareness acquisition strategies and the opportunity to practice employing them. It will also require an objective means to assess the student's ability to acquire the needed awareness. URS/Matrix recommends that the above hypothesis be tested and hopefully invalidated, prior to initiating Phase III.

4.2.12 Skill Training Feasibility

HYPOTHESIS: "Training drivers to avoid collisions through the acquisition of conflict nullification skills is not feasible."

DISCUSSION: The current program is geared to developing an all-encompassing accident avoidance skill training package, the feasibility of which will not be demonstrable until all modules have been pilot-tested. The analyses and limited experiments of Phase I indicate that such skill acquisition may be feasible. On that basis, preparation of the total accident avoidance skill training program was initiated, encompassing advanced driver skills and five basic multi-vehicle conflict situations. It has been suggested that a pre-pilot test be conducted to test the feasibility of the concept prior to utilizing time and funds to conduct the full developmental evaluation program. URS/Matrix agrees with this suggestion, even though we believe the hypothesis is not valid. Accordingly, we recommend that continuation of the Phase II developmental evaluation be structured to test the hypothesis.

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APPENDIX A

BIBLIOGRAPHY

APPENDIX A - BIBLIOGRAPHY OF ACCIDENT AVOIDANCE AND DRIVER TRAINING LITERATURE*

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ACCIDENT AVOIDANCE SKILL TRAINING
AND PERFORMANCE TESTING

FINAL REPORT

APPENDIX B

CURRICULUM AND PERFORMANCE MEASUREMENT SPECIFICATION

CURRICULUM AND PERFORMANCE MEASUREMENT SPECIFICATION

for

ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

Contract DOT-HS-4-00960

December 31, 1975

Prepared for

Department of Transportation
National Highway Traffic Safety Administration
Office of Driver and Pedestrian Research

Prepared by

URS/Matrix Company
7245 Arlington Boulevard
Falls Church, Virginia

PR-0530-19(A)

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ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

CURRICULUM AND PERFORMANCE MEASUREMENT SPECIFICATION

INTRODUCTION

ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

Curriculum and Performance Measurement Specification

Introduction

Specifications are set forth in this document that are expected to assure that the training course being developed under contract DOT-HS-4-00960 will aid student drivers facing conflict situations in executing workable accident avoidance strategies. The collision avoidance strategies to be taught and learned are, or are adaptations of, those recommended by Indiana University (IU) as a result of a comprehensive accident data analysis performed for URS/Matrix and NHTSA. Likewise, the five conflict situations to be presented to students are based on the conflict situations defined by IU during the same study. Actually teaching the execution of successful strategies will be accomplished by the use of three techniques:

- classroom instruction
- simulation practice
- driving range practice

Classroom instruction will be used solely to impart knowledge and to establish in the student the proper subconscious "set" considered requisite to the subsequent acquisition of vital perceptual, decision making and operational skills. These are the skills needed to nullify the basic conflict types postulated by Indiana University. After classroom instruction, both simulation and range driving practice will be used to extend and internalize the knowledge already gained, in order to develop the three vital skills.

Perceptual skills have sensory and cognitive components. Hence, both components must be developed if the driver being trained is to be able to detect and recognize the presence of conflict. To accomplish that, a bimodal driving simulation and two independent levels of range-driving practice sessions will be used. During "Beginning Driving Range" sessions, the student will learn basic evasive maneuvering and single-vehicle accident avoidance skills. During those sessions using the bimodal driving simulator and the "Advanced Driving Range", the student will learn to nullify multi-vehicle conflicts.

For multi-vehicle conflict situations, the student will first be subjected to equipment familiarization sessions and conflict nullification training in the bimodal simulator. To "drive" this simulator, the student will sit behind the normal vehicle controls: a steering wheel, a brake pedal and an accelerator pedal. There he will get the visual feel of entering various conflict situations by attending to a film presentation of various traffic conflicts (mode #1). While watching mode #1, the student will not be able to exercise any control over the visual image. At the point in the unfolding conflict where student control is desired, the movie presentation will be terminated and the second mode, in the form of a CRT display, will be activated. On the television screen, before the student, will be presented a dynamic plan view of a roadway complete with obstacles, traffic and the student car. It will be the student's task to drive his car down the road using the vehicle controls provided to negate any conflict he encounters. As he does that, his "vehicle" will respond both in kind and in magnitude to the control imputs made.

Although the bimodal simulation lacks one-to-one perceptual realism, through its use, student drivers should learn:

- To recognize some of the significant perceptual antecedents to conflict situations (film)
- To perceive and extrapolate the relative locations of other objects (including objects that are moving) with respect to an object under his control (CRT)
- To select and execute appropriate evasive maneuvers based upon acquired visual data (CRT)

It has already been noted that two kinds of range driving practice sessions will be employed to develop perceptual skills. These will provide the student his first interaction with perceptual realism. Descriptively, they will include practicing of basic vehicle maneuvers (e.g., skid recovery, slalom racing, lane switching, etc.) and of executing complex accident avoidance strategies. These sessions will be called beginning range practice, and the perceptual skills learned will contribute to the driver's ability to track the orientation of his vehicle with respect to the full-scale surrounding static environment. In the case of advanced range practice, the student will be developing the perceptual skills necessary to track the orientation of his car with respect to both fixed and dynamic obstacles in a full-scale driving environment.

In developing operational skills, both the simulation and the range practice techniques will make contributions. Because the bimodal simulation does provide the driver some limited experience in altering his "vehicle" path by kind and degree in response to simulated conflicts, he can be expected to develop some rudimentary skills in applying modulated vehicle control inputs. Then, during the more realistic range sessions, the rudimentary skills gained during the bimodal simulation practice should be forged into operational skills that are more useful in an actual driving environment.

During the beginning range practice, the training driver will develop an ability to modulate his vehicle control inputs during extreme maneuvers. These will allow him to maintain or regain the safe orientation of his car with respect to a static environment. Then, during the advanced range practice, when the student executes accident avoidance strategies, he will learn to integrate the simple operational skills already learned into effective complex control scenarios appropriate to the dynamic threats he is facing.

As the student is developing perceptual and operational skills through simulation and range practice, he will also be developing his decision making skills. Here the bimodal simulation and advanced range practice sessions will prove most beneficial. Both of these training techniques place the student in multi-moving body conflicts. Hence, the student must sample and integrate a complex array of perceptual data. As he does that, he must extrapolate the positions of all moving bodies with respect to the fixed environment; call up knowledge of his car's maneuvering capability and decide upon the appropriate control inputs. He must do that repeatedly until the faced conflict is nullified.

Of course, the decision making process for the beginning range practice is the same as the one just described for the advanced sessions. But, in the case of the less complicated beginning practice, the student's car is the only moving body. Hence, there is not the density of perceptual data to be processed that exists in the advanced practice.

Now all three of the teaching techniques and their relative general roles in developing knowledge, perceptual skills, operational skills and decision making skills have been discussed. Therefore, it is appropriate to turn to presenting the course structure. This will be done in terms of units of instruction.

Each of the available techniques will be administered to train drivers to overcome one of the five postulated conflict situations. Hence, each of the conflict situations will be addressed in a single unit of instruction or training module. To these five conflict-related training modules will be added two more. One will provide students with a general course orientation and basic evasive maneuvering driving skills. The other module will consist of an integrated, comprehensive test covering all conflicts and maneuvers. Thus, the training course being developed will contain the following seven modules:

Module 1 - Orientation and General Advanced Driver Skills

Module 2 - Collision Avoidance; Avoid being struck by intersecting vehicle.

Module 3 - Collision Avoidance; Avoid striking an intersecting vehicle.

Module 4 - Collision Avoidance; Avoid being struck by following vehicle.

Module 5 - Collision Avoidance; Avoid striking lead vehicle.

Module 6 - Collision Avoidance; Avoid head-on collision with oncoming vehicle.

Module 7 - Comprehensive Collision Avoidance Test.

Training specifications for each of these seven modules are presented in the following pages of this document in terms of purpose, objectives, and requirements for equipment, materials, facilities, personnel, and procedural data. Detailed specifications for complex and/or frequently required items are referenced.

TERMS AND DEFINITIONS

SYMBOLS

CV : Conflict Vehicle

SV : Subject Vehicle (SV), or Driver's Vehicle (DV)

□ : Lecture type submodule

◇ : Participation & practice submodule

○ : Proficiency testing submodule

⇨ : Designates path of vehicle for conditions stated

➡ : Designates path of vehicle, with braking, for conditions stated

▬ ▬ ▬ ▬ : Designates lane availability obstruction

TERMS

Advanced Driving Range (ADR): An automobile driving range for training of collision avoidance skills, using a surrogate vehicle as the conflict vehicle.

Bimodal Simulator (BMS): A specialized driving simulator which presents the conditions leading to a conflict from the driver's perspective in one visual mode, and the developing conflict on closed circuit TV in plan view, during which the driver can interact to attempt collision avoidance.

Conflict: A collision between two or more motor vehicles will result unless at least one driver responds with a correct avoidance maneuver, there is some potential for avoidance, and the compressed time frame limits recourse to normal safe driving practices.

Conflict Vehicle (CV): A vehicle with which the Driver's Vehicle (DV) is in conflict.

Driver's Vehicle (DV): The automobile driven by the person (being) trained in collision avoidance skills.

Obstacle: The drivers vehicle will strike the conflict vehicle if an avoidance maneuver is not made.

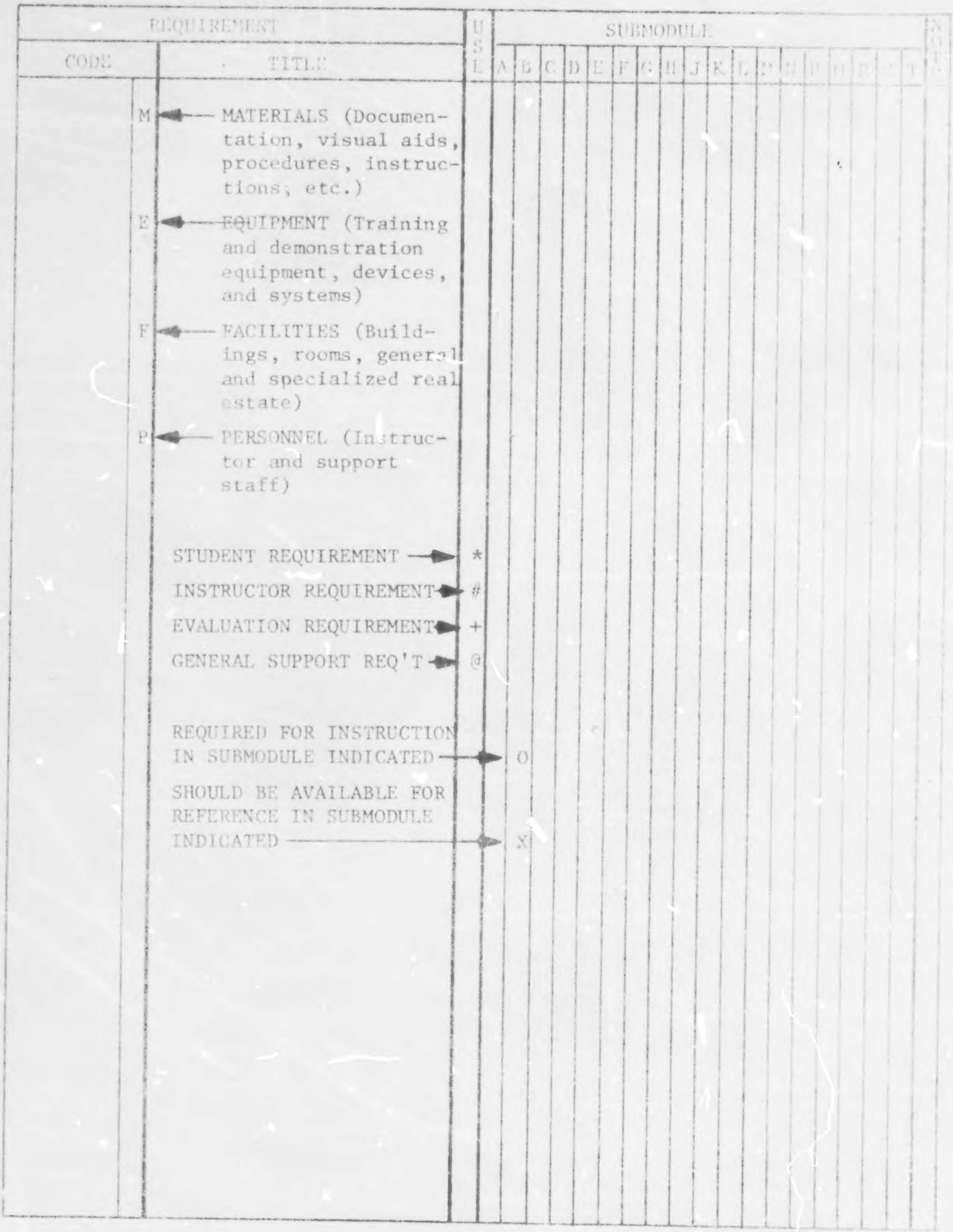
Obstruction: Any object or topographical feature which defines the limit of maneuvering space for the Driver's Vehicle (DV) (Subject Vehicle), except that the Conflict Vehicle (CV) is not considered an obstruction.

Subject Vehicle: See Driver's Vehicle (DV).

Surrogate Vehicle: A remotely controlled vehicle of very low mass having the visual appearance of an actual automobile; used as the conflict vehicle during Advanced Driving Range training and testing.

Threat: The conflict vehicle will strike the drivers vehicle.

In Tables 1-1, 2-1, 3-1, 4-1, 5-1, 6-1, and 7-1 the following notation system is used:



REQUIREMENT		U S L	SUBMODULE																		N O T E S
CODE	TITLE		A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	
M	← MATERIALS (Documentation, visual aids, procedures, instructions, etc.)																				
E	← EQUIPMENT (Training and demonstration equipment, devices, and systems)																				
F	← FACILITIES (Buildings, rooms, general and specialized real estate)																				
P	← PERSONNEL (Instructor and support staff)																				
	STUDENT REQUIREMENT →	*																			
	INSTRUCTOR REQUIREMENT →	#																			
	EVALUATION REQUIREMENT →	+																			
	GENERAL SUPPORT REQ'T →	@																			
	REQUIRED FOR INSTRUCTION IN SUBMODULE INDICATED →		O																		
	SHOULD BE AVAILABLE FOR REFERENCE IN SUBMODULE INDICATED →		X																		

MODULE NO: 1

ORIENTATION AND GENERAL ADVANCED DRIVER SKILLS

DENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

URRICULUM AND PERFORMANCE MEASUREMENT SPECIFICATION

MODULE NO: 1

RIENTATION AND GENERAL ADVANCED DRIVER SKILLS

SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

(1) MODULE NO: 1

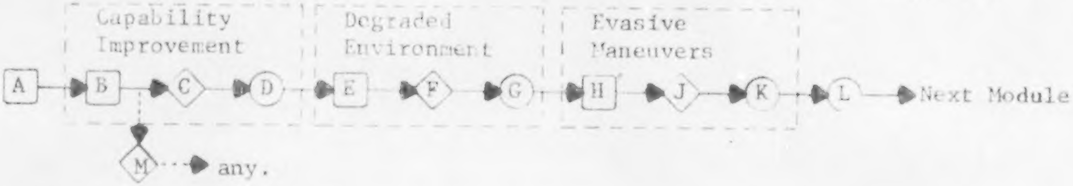
(2) MODULE TITLE: Orientation and General Advanced Driver Skills.

(3) PURPOSE OF MODULE: To provide students with an overall course orientation, knowledge of generally r
vehicle maneuvers, and the ability to perform selected vehicle control tasks and drastic maneuvers.

(4) STUDENT ENTRANCE PREREQUISITES: A valid automobile operator's license; a willingness to participate.

(5) APPLICABLE INSTRUCTION TECHNIQUES: Classroom instruction; Basic driving range.

(6) INSTRUCTIONAL APPROACH: Instruction will be given in a series of submodules:


Capability Improvement
Degraded Environment
Evasive Maneuvers
A
B
C
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G
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L
Next Module
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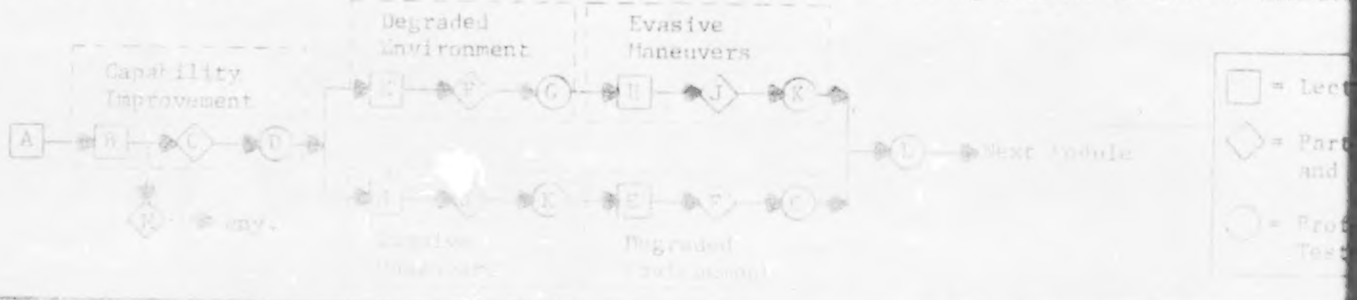
any.

A. Orientation Lecture.
B. Capability Improvement Training Lecture.
C. Capability Improvement Driving Range Practice.
D. Capability Improvement Proficiency Testing.
E. Degraded Environment Training Lecture.
F. Degraded Environment Driving Range Practice.
G. Degraded Environment Proficiency Testing.
H. Evasive Maneuver Training Lecture.
J. Evasive Maneuver Driving Range Practice.
K. Evasive Maneuver Proficiency Testing.
L. Integrated Maneuvers Proficiency Testing.
M. Bimodal Simulator Familiarization Practi

If range size and capacity permits, the sequence of instruction may be rearranged as follows, with a p
class undergoing degraded environment training while the remainder are being trained in evasive maneuv


Degraded Environment
Evasive Maneuvers
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ST-6550-2/7

FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

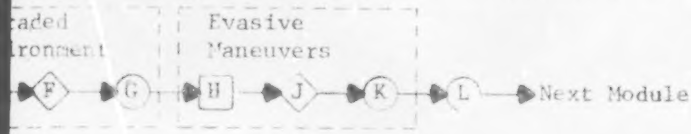
Orientation and General Advanced Driver Skills.

tudents with an overall course orientation, knowledge of generally required drastic
ty to perform selected vehicle control tasks and drastic maneuvers.

A valid automobile operator's license; a willingness to participate.

S: Classroom instruction; Basic driving range.

tion will be given in a series of submodules:



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Next Module

Lecture.
Range Practice.
ency Testing.
Lecture.
ange Practice.

G. Degraded Environment Proficiency Testing.
H. Evasive Maneuver Training Lecture.
J. Evasive Maneuver Driving Range Practice.
K. Evasive Maneuver Proficiency Testing.
L. Integrated Maneuvers Proficiency Testing.
M. Bimodal Simulator Familiarization Practice.

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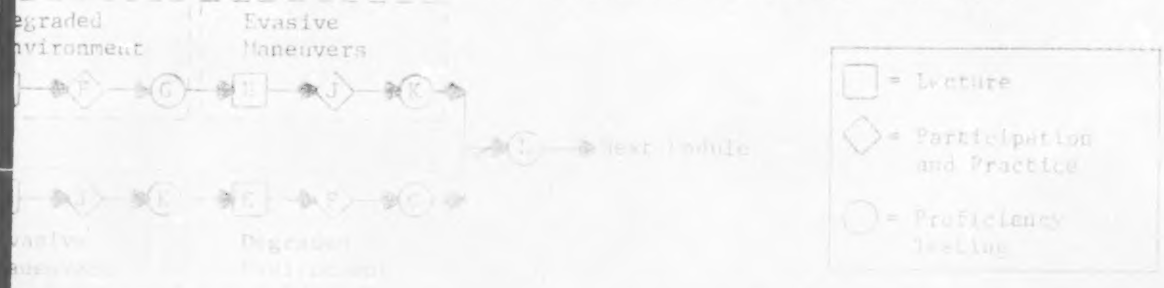
ment training while the remainder are being trained in evasive maneuvers:



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Next Module
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aneuvers
Degraded
Environment
= Lecture
= Participation and Practice
= Proficiency Testing

Prepared By:

Approved By:

Page

SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 1.

② MODULE TITLE: Orientation and General Advanced Driver Skills

⑦ SUBMODULE NO: 1.A.

⑧ SUBMODULE TITLE: Orientation Lecture

⑨ SUBMODULE OBJECTIVES:

(1) Familiarize students with scope and nature of training course.
(2) Familiarize students with scope and nature of Module #1.
(3) Complete all forms and training/testing schedules.
(4) Familiarize students with operation of the Bimodal Simulator.
(5) Familiarize students with the layout and use of the automobile driving range.
(6) Instill in each student an appreciation of the importance of advanced driver education.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Waiver forms and parental consent fo
must be completed prior to entering

(2) Orientation lecture should be given
students as a group, requiring the u
classroom or small auditorium. Total
not exceed 40 students.

⑪ STUDENT MATERIALS:
See Table 1-1

⑫ INSTRUCTOR MATERIALS:
See Table 1-1

⑬ EVALUATION MATERIALS:
See Table 1-1

⑭ SUPPORT
See Table 1

Issue Date: 12/25/75	Revision No: 4	Prepared By: G. R. Hatterick	Approved By:	P

PF-0530-1/2 (a)

IFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

TITLE: Orientation and General Advanced Driver Skills

LE TITLE: Orientation Lecture

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river education.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Waiver forms and parental consent forms (if applicable) must be completed prior to entering Submodule 1.B.

(2) Orientation lecture should be given to all selected students as a group, requiring the use of a large classroom or small auditorium. Total class should not exceed 40 students.

⑫ INSTRUCTOR MATERIALS:

See Table 1-1

⑬ EVALUATION MATERIALS:

See Table 1-1

⑭ SUPPORT REQUIREMENTS:

See Table 1-1

	Prepared By: G. R. Hatterick	Approved By:	Page 1-2

SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 1	② MODULE TITLE: Orientation and General Advanced Driver Skills.
⑦ SUBMODULE NO: 1.B.	⑧ SUBMODULE TITLE: Capability Improvement Training Lecture.

⑨ SUBMODULE OBJECTIVES:

(1) To develop in the student a familiarity with basic factors which will assist in improving driving performance:
  (a) Correct seating position;
  (b) Correct steering wheel grip;
  (c) Use of lap and shoulder restraints.

(2) To develop in the student a cognizance of the characteristics of the following maneuvers:
  (a) Emergency stop, straight line;
  (b) Acceleration, transmission-aided;
  (c) Deceleration, transmission-aided;
  (d) High-G cornering;
  (e) Serpentine maneuver;
  (f) Interrupted serpentine maneuver.

(3) To develop in the student an awareness of the conditions under which the above maneuvers may be employed to avoid, or reduce the effects of, an accident.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) At any time following this submodule, are not directly involved in another complete Submodule #1.M. Must be comp start of Module #2.

(2) It is recommended that the class be l to not more than 20 students for maxi instructor interaction.

⑪ STUDENT MATERIALS:	⑫ INSTRUCTOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPORT
See Table 1-1	See Table 1-1	See Table 1-1	See Table 1-

Issue Date: 12/24/75	Revision No: 3	Prepared By: G.R.Hatterick	Approved By:	Pa

PF-0530-1/2 (a)

ICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

TLE: Orientation and General Advanced Driver Skills.

TITLE: Capability Improvement Training Lecture.

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n improving driving

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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) At any time following this submodule, students who are not directly involved in another submodule may complete Submodule #1.M. Must be completed prior to start of Module #2.

(2) It is recommended that the class be limited in size to not more than 20 students for maximum student-instructor interaction.

⑫ INSTRUCTOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPORT REQUIREMENTS:
See Table 1-1	See Table 1-1	See Table 1-1

Prepared By: G.R.Hatterick	Approved By:	Page 1-3

SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 1	② MODULE TITLE: Orientation and General Advanced Driver Skills
⑦ SUBMODULE NO: 1.C	⑧ SUBMODULE TITLE: Capability Improvement Driving Range Practice

⑨ SUBMODULE OBJECTIVES:

(1) To develop in the student driver an ability to modulate control inputs to the vehicle for the following maneuvers:
  (a) Emergency stop, straight line;
  (b) Acceleration, transmission-aided;
  (c) Deceleration, transmission-aided;
  (d) High-G cornering;
  (e) Serpentine maneuver;
  (f) Interrupted serpentine maneuver.

(2) To increase the probability that the student driver can maintain or regain the safe orientation of his vehicle when required to execute the maneuvers in this group.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Only student participants and requi staff will be permitted on the rang submodule.

(2) All range safety equipment and proc verified prior to initiating demons student practice sessions.

(3) Range Safety Monitor must be on dut during the use of the range.

(4) Class should be split into 2 groups on straight line exercises and half exercises on separate portions of t

(5) Research objective: Determine the a time required to enable students to desired level of proficiency in Sub

⑪ STUDENT MATERIALS: See Table 1-1	⑫ INSTRUCTOR MATERIALS: See Table 1-1	⑬ EVALUATION MATERIALS: See Table 1-1	⑭ SUPPOR See Ta

Issue Date: 12/24/75	Revision No: 3	Prepared By: G. R. Hatterick	Approved By:

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SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

DULE TITLE: Orientation and General Advanced Driver Skills

BMODULE TITLE: Capability Improvement Driving Range Practice

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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Only student participants and required instructor staff will be permitted on the range during this submodule.

(2) All range safety equipment and procedures will be verified prior to initiating demonstration and/or student practice sessions.

(3) Range Safety Monitor must be on duty at all times during the use of the range.

(4) Class should be split into 2 groups; half working on straight line exercises and half on steering exercises on separate portions of the range.

(5) Research objective: Determine the average practice time required to enable students to reach the minimum desired level of proficiency in Submodule #1.D.

⑫ INSTRUCTOR MATERIALS:

See Table 1-1

⑬ EVALUATION MATERIALS:

See Table 1-1

⑭ SUPPORT REQUIREMENTS:

See Table 1-1

ion 3	Prepared By: G. R. Hatterick	Approved By:	Page 1-4

① MODULE NO:
1

② MODULE TITLE:
Orientation and General Advanced Driver Skills

⑦ SUBMODULE NO:
1.D.

⑧ SUBMODULE TITLE:
Capability Improvement Proficiency Testing

⑨ SUBMODULE OBJECTIVES:

(1) To ascertain that each student has attained a level of proficiency in the execution of the following maneuvers that they can be expected to perform them successfully, when needed, in a real world environment:

(a) Emergency stop, straight line;
(b) Acceleration, transmission-aided;
(c) Deceleration, transmission-aided;
(d) High-G cornering;
(e) Serpentine maneuver;
(f) Interrupted serpentine maneuver.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Only student participants and require staff will be permitted on the range submodule.

(2) All range safety equipment and proced verified prior to initiating demonstr student practice sessions.

(3) Range Safety Monitor must be on duty during the use of the range.

(4) Half of class can be tested on straig while remainder are being tested on s

(5) Research Objective: Determine the lev in the execution of these maneuvers t by the student as a result of complet 1.A, 1.B, and 1.C.

⑪ STUDENT MATERIALS:
See Table 1-1

⑫ INSTRUCTOR MATERIALS:
See Table 1-1

⑬ EVALUATION MATERIALS:
See Table 1-1

⑭ SUPPOR
See Tab

Issue Date: 12/24/75	Revision No: 3	Prepared By: G. R. Hatterick	Approved By:

PECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

LE TITLE:
Orientation and General Advanced Driver Skills

DULE TITLE:
Capability Improvement Proficiency Testing

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can be expected to perform them
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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Only student participants and required instructor staff will be permitted on the range during this submodule.

(2) All range safety equipment and procedures will be verified prior to initiating demonstration and/or student practice sessions.

(3) Range Safety Monitor must be on duty at all times during the use of the range.

(4) Half of class can be tested on straight-line exercises while remainder are being tested on steering exercises.

(5) Research Objective: Determine the level of proficiency in the execution of these maneuvers that can be achieved by the student as a result of completion of submodule 1.A, 1.B, and 1.C.

⑫ INSTRUCTOR MATERIALS: See Table 1-1	⑬ EVALUATION MATERIALS: See Table 1-1	⑭ SUPPORT REQUIREMENTS: See Table 1-1

on 3	Prepared By: G. R. Hatterick	Approved By:	Page 1-5

SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 1

② MODULE TITLE: Orientation and General Advanced Driver Skills

⑦ SUBMODULE NO: 1.E.

⑧ SUBMODULE TITLE: Degraded Environment Training Lecture

⑨ SUBMODULE OBJECTIVES:

(1) To develop in the student an understanding of the changes in automobile handling characteristics which accompany various types of degraded environments.

(2) To develop in the student a cognizance of the characteristics of the following maneuvers:

- (a) Braking on skid pad;
- (b) Steering on skid pad;
- (c) Acceleration on skid pad;
- (d) Combined steering and braking on skid pad;
- (e) Off-road recovery;
- (f) Blow-out recovery.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

⑪ STUDENT MATERIALS: See Table 1-1

⑫ INSTRUCTOR MATERIALS: See Table 1-1

⑬ EVALUATION MATERIALS: See Table 1-1

⑭ SUPPORT

See Tabl

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PF-0530-1/2 (a)

TION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

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on and General Advanced Driver Skills

TLE: Degraded Environment Training Lecture

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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

INSTRUCTOR MATERIALS: See Table 1-1	⑬ EVALUATION MATERIALS: See Table 1-1	⑭ SUPPORT REQUIREMENTS: See Table 1-1

Prepared By: G. R. Hatterick	Approved By:	Page 1-6

SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 1

② MODULE TITLE: Orientation and General Advanced Driver Skills

⑦ SUBMODULE NO: 1.F.

⑧ SUBMODULE TITLE: Degraded Environment Driving Range Practice

⑨ SUBMODULE OBJECTIVES:

(1) To develop in the student driver an ability to modulate control inputs to the vehicle for the following maneuvers;

- (a) Braking on skid pad;
- (b) Steering on skid pad;
- (c) Acceleration on skid pad;
- (d) Combined steering and braking on skid pad;
- (e) Off-road recovery;
- (f) Blow-out recovery.*

(2) To increase the probability that the student driver can maintain or regain the safe orientation of his vehicle when required to execute the maneuvers in this group.

*Note: See Block ⑩, Paragraph (5)

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Only student participants and required in staff will be permitted on the range duri submodule.

(2) All range safety equipment and procedures verified prior to initiating demonstratio student practice sessions.

(3) Range Safety Monitor must be on duty at a during the use of the range.

(4) Research objective: To determine the aver time required for students to achieve the proficiency levels in submodule 1.G.

(5) Although the blow-out recovery exercise f the expense associated with a blow-out si the fact that tire blowouts are no longer producers, make the blow-out recovery exe It will be excluded from this research pr

(6) Part of class can be training on skid pad while the remainder are training in other

⑪ STUDENT MATERIALS: See Table 1-1

⑫ INSTRUCTOR MATERIALS: See Table 1-1

⑬ EVALUATION MATERIALS: See Table 1-1

⑭ SUPPORT REQU See Table 1-

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Prepared By: G. R. Hatterick

Approved By:

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CATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

LE:
Orientation and General Advanced Driver Skills

TITLE:
Degraded Environment Driving Range Practice

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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Only student participants and required instructor staff will be permitted on the range during this submodule.

(2) All range safety equipment and procedures will be verified prior to initiating demonstration and/or student practice sessions.

(3) Range Safety Monitor must be on duty at all times during the use of the range.

(4) Research objective: To determine the average practice time required for students to achieve the desired proficiency levels in submodule 1.G.

(5) Although the blow-out recovery exercise is desirable, the expense associated with a blow-out simulator, and the fact that tire blowouts are no longer major accident producers, make the blow-out recovery exercise optional. It will be excluded from this research program.

(6) Part of class can be training on skid pad exercises while the remainder are training in other exercises.

INSTRUCTOR MATERIALS: See Table 1-1	⑬ EVALUATION MATERIALS: See Table 1-1	⑭ SUPPORT REQUIREMENTS: See Table 1-1

Prepared By: G. R. Hatterick	Approved By:	Page 1-7

SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 1	② MODULE TITLE: Orientation and General Advanced Driver Skills
⑦ SUBMODULE NO: 1.C.	⑧ SUBMODULE TITLE: Degraded Environment Proficiency Testing

⑨ SUBMODULE OBJECTIVES:

(1) To ascertain that each student has attained a level of proficiency in the execution of the following maneuvers that they can be expected to perform them successfully, when needed, in a real world environment;

- (a) Braking on skid pad;
- (b) Steering on skid pad;
- (c) Acceleration on skid pad;
- (d) Combined steering and braking on skid pad;
- (e) Off-road recovery;
- (f) Blow-out recovery.*

*Note: See Block ⑩, paragraph (5).

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Only student participants and required i staff will be permitted on the range dur submodule.

(2) All range safety equipment and procedure verified prior to initiating demonstrati student practice sessions.

(3) Range Safety Monitor must be on duty at during the use of the range.

(4) Research objective; To determine the lev ficiency in execution of the above maneu can be achieved by the students as a re completion of Submodules 1.A., 1.E., and this course.

(5) Although the blow-out recovery exercise the expense associated with a blow-out the fact that tire blow-outs are no lon accident producers, make the blow-out r exercise optional. It will be excluded research program.

(6) Part of class can be tested on skid pad while remainder are being tested on off etcetera.

⑪ STUDENT MATERIALS: See Table 1-1	⑫ INSTRUCTOR MATERIALS: See Table 1-1	⑬ EVALUATION MATERIALS: See Table 1-1	⑭ SUPPORT See Table

Issue Date: 12/24/75	Revision No: 3	Prepared By: G.R. Hatterick	Approved By:	Pa

PF-0530-1/2 (a)

FICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

ITLE:

Orientation and General Advanced Driver Skills

E TITLE:

Degraded Environment Proficiency Testing

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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Only student participants and required instructor staff will be permitted on the range during this submodule.

(2) All range safety equipment and procedures will be verified prior to initiating demonstration and/or student practice sessions.

(3) Range Safety Monitor must be on duty at all times during the use of the range.

(4) Research objective; To determine the level of proficiency in execution of the above maneuvers that can be achieved by the students as a result of completion of Submodules 1.A., 1.E., and 1.F. of this course.

(5) Although the blow-out recovery exercise is desirable the expense associated with a blow-out simulator, and the fact that tire blow-outs are no longer major accident producers, make the blow-out recovery exercise optional. It will be excluded from this research program.

(6) Part of class can be tested on skid pad exercises while remainder are being tested on off-road recovery, etcetera.

⑫ INSTRUCTOR MATERIALS: See Table 1-1	⑬ EVALUATION MATERIALS: See Table 1-1	⑭ SUPPORT REQUIREMENTS: See Table 1-1

3	Prepared By: G.R. Hatterick	Approved By:	Page 1-8

SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 1	② MODULE TITLE: Orientation and General Advanced Driver Skills
⑦ SUBMODULE NO: 1.H.	⑧ SUBMODULE TITLE: Evasive Maneuver Training Lecture

⑨ SUBMODULE OBJECTIVES:

(1) To develop in the student a cognizance of the characteristics of the following maneuvers:

- (a) Evasive steering - single object;
- (b) Evasive steering - multiple object;
- (c) Evasive steering - moving object;
- (d) Evasive steering and braking.

(2) To develop in the student an awareness of the conditions under which the above maneuvers may be employed to avoid, or reduce the effects of, an accident.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

⑪ STUDENT MATERIALS: See Table 1-1	⑫ INSTRUCTOR MATERIALS: See Table 1-1	⑬ EVALUATION MATERIALS: See Table 1-1	⑭ SUPPORT REQ See Table 1

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CATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

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TITLE:
Evasive Maneuver Training Lecture

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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

2) INSTRUCTOR MATERIALS:
See Table 1-1

⑬ EVALUATION MATERIALS:
See Table 1-1

⑭ SUPPORT REQUIREMENTS:
See Table 1-1

Prepared By: G. R. Hatterick

Approved By:

① MODULE NO:
1

② MODULE TITLE:
Orientation and General Advanced Driver Skills

⑦ SUBMODULE NO:
1.J.

⑧ SUBMODULE TITLE:
Evasive Maneuver Driving Range Practice

⑨ SUBMODULE OBJECTIVES:

(1) To develop in the student driver an ability to modulate control inputs to the vehicle for the following maneuvers;

(a) Evasive steering - singe object;
(b) Evasive steering - multiple object;
(c) Evasive steering - moving object;
(d) Evasive steering and braking.

(2) To increase the probability that the student driver can maintain or regain the safe orientation of his vehicle when required to execute the maneuvers in this group.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Only student participants and required staff will be permitted on the range d
submodule.

(2) All range safety equipment and procedu
verified prior to initiating demonstra
student practice sessions.

(3) Range Safety Monitor must be on duty a
during the use of the range.

(4) Research objective: To determine the a
time required for students to achieve
proficiency levels in Submodule #1.K.

⑪ STUDENT MATERIALS:
See Table 1-1

⑫ INSTRUCTOR MATERIALS:
See Table 1-1

⑬ EVALUATION MATERIALS:
See Table 1-1

⑭ SUPPORT
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ION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

Orientation and General Advanced Driver Skills

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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Only student participants and required instructor staff will be permitted on the range during this submodule.

(2) All range safety equipment and procedures will be verified prior to initiating demonstration and/or student practice sessions.

(3) Range Safety Monitor must be on duty at all times during the use of the range.

(4) Research objective: To determine the average practice time required for students to achieve the desired proficiency levels in Submodule #1-K.

INSTRUCTOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPORT REQUIREMENTS:
See Table 1-1	See Table 1-1	See Table 1-1

Prepared By: G.R. Hatterick	Approved By:	Page 1-10

SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 1	② MODULE TITLE: Orientation and General Advanced Driver Skills
⑦ SUBMODULE NO: 1.K.	⑧ SUBMODULE TITLE: Evasive Maneuver Proficiency Testing

⑨ SUBMODULE OBJECTIVES:

(1) To ascertain that each student has attained a level of proficiency in the execution of the following maneuvers that they can be expected to perform them successfully, when needed, in a real world environment:

(a) Evasive steering - single object;
(b) Evasive steering - multiple object;
(c) Evasive steering - moving object;
(d) Evasive steering and braking.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Only student participants and required staff will be permitted on the range d submodule.

(2) All range safety equipment and procedu verified prior to initiating demonstra student practice sessions.

(3) Range Safety Monitor must be on duty a during the use of the range.

(4) Research objective; To determine the l ficiency in execution of the above man can be achieved by the students as a r completion of Submodules#1.A., 1.H., a this course.

⑪ STUDENT MATERIALS: See Table 1-1	⑫ INSTRUCTOR MATERIALS: See Table 1-1	⑬ EVALUATION MATERIALS: See Table 1-1	⑭ SUPPORT RE See Table 1

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FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

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Evasive Maneuver Proficiency Testing

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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Only student participants and required instructor staff will be permitted on the range during this submodule.

(2) All range safety equipment and procedures will be verified prior to initiating demonstration and/or student practice sessions.

(3) Range Safety Monitor must be on duty at all times during the use of the range.

(4) Research objective; To determine the level of proficiency in execution of the above maneuvers that can be achieved by the students as a result of completion of Submodules#1.A., 1.H., and 1.J. of this course.

STRUCTOR MATERIALS: e Table 1-1	⑬ EVALUATION MATERIALS: See Table 1-1	⑭ SUPPORT REQUIREMENTS: See Table 1-1

Prepared By: G. R. [illegible]	Approved By:	Page [illegible]-11

SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 1

② MODULE TITLE: Orientation and General Advanced Driver Skills

⑦ SUBMODULE NO: 1.L.

⑧ SUBMODULE TITLE: Integrated Maneuvers Proficiency Testing

⑨ SUBMODULE OBJECTIVES:

(1) To ascertain that the student has attained a level of proficiency in the execution of the following maneuvers that they can be expected to perform the maneuvers successfully on a demand-response basis:

(a) Emergency stop, straight line;
(b) Acceleration, transmission-aided,
(c) Deceleration, transmission-aided;
(d) Braking on skid pad;
(e) Steering on skid pad;
(f) Acceleration on skid pad;
(g) Evasive steering - single object;
(h) Evasive steering - multiple object;
(i) Evasive steering and stop;
(j) Steering and braking on skid pad;
(k) Off-road recovery;
(l) High-G cornering;
(m) Serpentine maneuver;
(n) Interrupted serpentine maneuver;
(o) Blow-out recovery*;
(p) Evasive steering-moving object.

*Note: See Block ⑩, paragraph #(5)

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Only student participants and required i
staff will be permitted on the range dur
submodule.

(2) All range safety equipment and procedure
verified prior to initiating demonstrati
student practice sessions.

(3) Range Safety Monitor must be on duty at
during the use of the range.

(4) Research Objective: To determine the lev
ficiency in execution of the above maneu
can be achieved by the students as a res
completion of submodule #1.A through #1

(5) Although the blow-out recovery exercise
the expense associated with a blow-out s
the fact that tire blow-outs are no long
accident producers, make the blow-out re
exercise optional. It will be excluded f
research program.

⑪ STUDENT MATERIALS: See Table 1-1

⑫ INSTRUCTOR MATERIALS: See Table 1-1

⑬ EVALUATION MATERIALS: See Table 1-1

⑭ SUPPORT R
See Table 1

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PF-0530-1/2 (a)

ATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

E:

Orientation and General Advanced Driver Skills

ITLE:

Integrated Maneuvers Proficiency Testing

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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Only student participants and required instructor staff will be permitted on the range during this submodule.

(2) All range safety equipment and procedures will be verified prior to initiating demonstration and/or student practice sessions.

(3) Range Safety Monitor must be on duty at all times during the use of the range.

(4) Research Objective: To determine the level of proficiency in execution of the above maneuvers that can be achieved by the students as a result of completion of submodule #1.A through #1.K.

(5) Although the blow-out recovery exercise is desirable the expense associated with a blow-out simulator, and the fact that tire blow-outs are no longer major accident producers, make the blow-out recovery exercise optional. It will be excluded from this research program.

2 INSTRUCTOR MATERIALS: See Table 1-1	⑬ EVALUATION MATERIALS: See Table 1-1	⑭ SUPPORT REQUIREMENTS: See Table 1-1

Prepared By: G. R. Hatterick	Approved By:	Page 1-12

SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 1	② MODULE TITLE: Orientation and General Advanced Driver Skills
⑦ SUBMODULE NO: 1.M.	⑧ SUBMODULE TITLE: Bimodal Simulator Familiarization Practice.

⑨ SUBMODULE OBJECTIVES:

(1) To provide the student with an opportunity to learn how to operate the Bimodal Simulator effectively, and to correctly interpret the spatial and temporal relationships projected on the viewscreen, using the following typical practice exercises:
- (a) Straight road;
- (b) Curve in road (left and right);
- (c) Winding road;
- (d) Obstacle in road;
- (e) Lane maintenance with traffic;
- (f) Lane maintenance against traffic.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) This submodule may be scheduled for each
an individual basis after completion of
#1.A; Must be completed prior to enterin

(2) Research Objective: Evaluate any unusual
which students may have in the use of th

⑪ STUDENT MATERIALS: See Table 1-1	⑫ INSTRUCTOR MATERIALS: See Table 1-1	⑬ EVALUATION MATERIALS: See Table 1-1	⑭ SUPPORT RE See Table 1-1

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TION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

: Orientation and General Advanced Driver Skills

TLE: Bimodal Simulator Familiarization Practice.

an opportunity to learn
imulator effectively,
he spatial and temporal
he viewscreen, using the
xercises:

right);

affic;
traffic.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) This submodule may be scheduled for each student on an individual basis after completion of Submodule #1.A; Must be completed prior to entering Module #2.

(2) Research Objective: Evaluate any unusual difficulties which students may have in the use of the simulator.

) INSTRUCTOR MATERIALS:

See Table 1-1

⑬ EVALUATION MATERIALS:

See Table 1-1

⑭ SUPPORT REQUIREMENTS:

See Table 1-1

Prepared By C. R. Hatterick

Approved By:

Table 1-1: TRAINING AND TESTING MATERIALS, EQUIPMENT, FACILITIES AND STAFF for MODULE # 1, **Orientation and General Advanced Driver Skills**

REQUIREMENT			USE	SUBMODULE																		NOTE
CODE		TITLE		A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	
0001	M	Course Summary	*	O	X			X			X											
			#	O																		
0002	M	Module Summary, Module #1	*	O	X			X			X											
			#	O	X			X			X											
0003	M	Course Schedule	*	O																		
			#	X																		
0004	M	Student Schedule Card	*	O	X	X	X	X	X	X	X	X	X	X	X							
0005	M	Student Master Schedule	#	O	O	O	O	O	O	O	O	O	O	O	O							
0006	M	Range Layout Diagrams	*	O	O	X	X	O	X	X	O	X	X	X								
			#	O	X	X	X	X	X	X	X	X	X	X								
0007	M	Range Layout Display	@	O	O			O			O											
0008	M	Bimodal Simulator Instructions	*	O											O							
			#	O											O							
0009	M	Range Instructions & Safety Rules	*	O	O	O	X	O	O	X	O	O	X	X								
			#	O	X	X	X	X	X	X	X	X	X	X								
0010	M	Equipment/Materials Checklist	#	O	O	O	O	O	O	O	O	O	O	O	O							
0011	M	Student Enrollment Standards	*	O																		
			#	O	X	X	X	X	X	X	X	X	X	X	X							
0012	M	Risk/Waiver Forms	*	O																		
			#	O	X	X	X	X	X	X	X	X	X	X								
0013	M	Parental Consent Forms	*	O																		
			#	O																		
			@		X	X	X	X	X	X	X	X	X	X	X							
0014	M	Instruction Procedure, Submodule	#	O	O	O	X	O	O	X	O	O	X	X	O							
0015	M	Content Material, Submodule	#	O	O	O	X	O	O	X	O	O	X	X	O							
0016	M	Orientation Movie, Course (Accident Avoidance Skills)	#	O																		
0017	M	Orientation Movie, Module #1 (General Adv. Driver Skills)	#	O																		
0018	M	Orientation Movie, General (Traffic Safety)	#	O																		
0019	E	Projector, Movie (8mm)	@	O	O			O			O				O							2

See page B-12 of specification for explanation of symbols

Table 1-1: TRAINING AND TESTING MATERIALS, EQUIPMENT, FACILITIES AND STAFF for MODULE #1 , Orientation and General Advanced Driver Skills

REQUIREMENT			USE	SUBMODULE																		TOTAL
CODE		TITLE		A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	
0020	P	Instructor, Classroom(I)	@	O	O			O			O											
0021	P	Instructor, Classroom(II)	@	O	O			O			O				O							
0022	E	Bimodal Simulator	#	O											O							
			*												O							
			@	X																		
0027	E	Screen, Projection	@	O	O			O			O											
0023	M	Maneuvers List, Submodule	*		O	O		O	O		O	O			O							
			#		O	X	X	O	X	X	O	X	X	X	O							
0024	M	Maneuvers Description/ Illustration	*		O			O			O				O							
			#		O			O			O				O							
0025	M	Maneuvers Procedures	*		O	O		O	O		O	O			O							
			#		O	X	X	O	X	X	O	X	X	X	O							
0026	M	Capability Improvement Movie	#		O																	
0028	M	Capability Improvement Slides	#		O																	
0029	E	Projector, Slide (35mm)	@		O			O			O											
0030	E	Projector, Movie (16mm)	@		O			O			O											2
0031	E	Driver Station Demonstration Unit	#	X	O																	
0032	M	Attendance Record	@	O	O	O	O	O	O	O	O	O	O	O	O							
0033	M	Student Performance Checklist	+			O	O		O	O		O	O	O	O							
0034	M	Video Tape Records	+			O	O		O	O		O	O	O	O							
0035	P	Range Operations Coordinator	@			O	O		O	O		O	O	O								
0036	P	Instructor, Range (I)	@			O	O		O	O		O	O	O								
0037	P	Instructor, Range (II)	@			O	O		O	O		O	O	O								
0038	F	Range, Automobile Driving	@			O	O		O	O		O	O	O								
0039	E	Automobile, Driver Training	@			O	O		O	O		O	O	O								3
0040	F	Classroom (I)	@	O																		[illegible]
0041	F	Classroom (II)	@		O			O			O				O							1
0042	E	Range Marker Cones	@	X		O	O		O	O		O	O	O								

Table 1-1 : TRAINING AND TESTING MATERIALS, EQUIPMENT, FACILITIES AND STAFF for MODULE #1 , Orientation and General Advanced Driver Skills

REQUIREMENT			USE	SUBMODULE																		NOTE
CODE		TITLE		A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	
0043	E	Range Signal Flags	@	X		O	O		O	O		O	O	O								
0044	M	Range Marker Stripes	@	X		O	O		O	O		O	O	O								
0045	E	Walkie-Talkies	@	X		O	O		O	O		O	O	O								
0046	E	Loudspeaker System	@			O	O		O	O		O	O	O								
0047	E	First Aid Kit	@	X		O	O		O	O		O	O	O								
0048	E	Video Camera	@			O	O		O	O		O	O	O	O							
0049	E	Video Recorder/Player	@			O	O		O	O		O	O	O	O							
0050	E	Video Monitor (I)	+			O	O		O	O		O	O	O								
			@	X																		
0052	E	Helmets, Crash	@	X		O	O		O	O		O	O	O								
0053	M	Range Operation Checklist	@			O	O		O	O		O	O	O								
0054	P	Range Crew	@			O	O		O	O		O	O	O								
0055	E	Range Support Vehicles	@			O	O		O	O		O	O	O								
0056	M	Maneuvers Sequence List Submodule #1	#				O			O			O	O	O							
0057	M	Degraded Environment Movie	#					O														
0058	M	Degraded Environment Slides	#					O														
0059	M	Evasive Maneuver Movie	#								O											
0060	M	Evasive Maneuver Slides	#								O											
0061	M	Simulator Films	*												O							
			#												O							
0051	E	Video Monitor (II)	*												O							
0067	E	Emergency Equipment	@			X	X		X	X		X	X	X								

Notes: (1) Choices of classroom depends on class size.

(2) Choices of movie projector depends on type of film used.

(3) Two required.

ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

CURRICULUM AND PERFORMANCE MEASUREMENT SPECIFICATION

MODULE NO: 2

COLLISION AVOIDANCE

AVOID BEING STRUCK BY INTERSECTING VEHICLE

(Intersecting Vehicle Threat)

SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

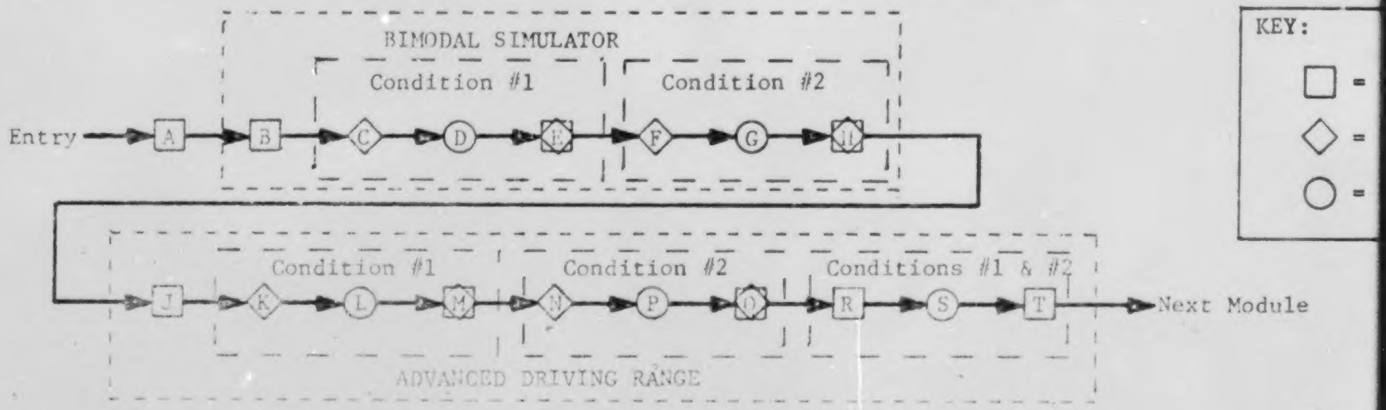
(1) MODULE NO: 2	(2) MODULE TITLE: Collision Avoidance; Avoid being struck by intersecting vehicle.

(3) PURPOSE OF MODULE: To provide students with the perceptual skills to recognize this type of conflic
maneuvering skills to successfully avoid, or reduce the effects of, a collision.

(4) STUDENT ENTRANCE PREREQUISITES: Completion of Module #1; a valid automobile operator's license.

(5) APPLICABLE INSTRUCTION TECHNIQUES: Classroom lecture; Bimodal simulator; Advanced driving range.

(6) INSTRUCTIONAL APPROACH: Instruction will be given in a series of submodules:



A: Lecture- Intersecting vehicle threat
B: Bimodal Simulator Demonstration
C: Simulator Practice, Condition #1
D: Simulator Test, Condition #1
E: Simulator Test Debriefing, Condition #1
F: Simulator Practice, Condition #2
G: Simulator Test, Condition #2
H: Simulator Test Debriefing, Condition #2
J: Advanced Driving Range Demonstration
K: Advanced Range Practice, Condition #1
L: Advanced Range Test, Condition #1

M: Advanced Range Test Debriefing, Condition #1
N: Advanced Range Practice, Condition #2
P: Advanced Range Test, Condition #2
Q: Advanced Range Test Debriefing, Condition #2
R: Pre-test Briefing, Advanced Range, Integrated
S: Advanced Range Test, Integrated Conditions #1
T: Advanced Range Test Debriefing, Integrated Co

CONDITIONS:

#1 - Intersecting vehicle will impact front hal
vehicle, on left or right side, if not suc
#2 - Intersecting vehicle will impact rear half
vehicle, on left or right side, if not suc

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ON FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

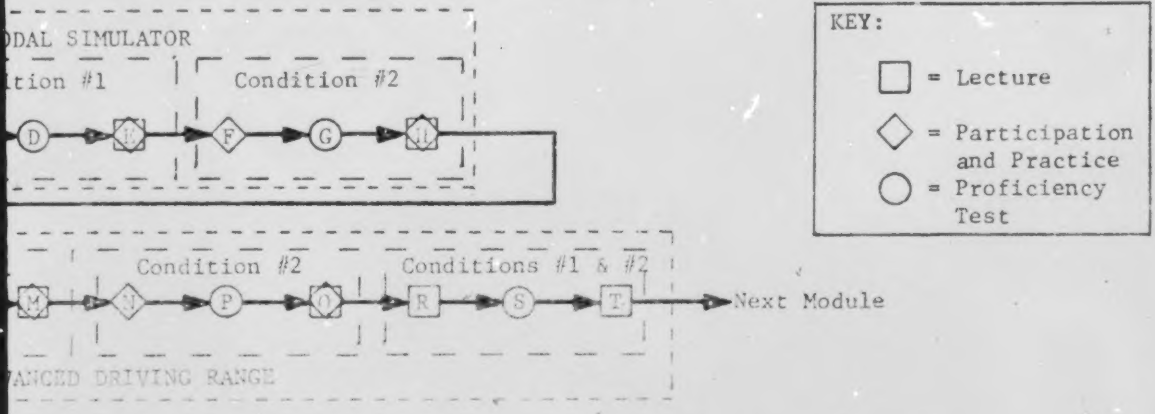
: Collision Avoidance; Avoid being struck by intersecting vehicle.

students with the perceptual skills to recognize this type of conflict, and the skills to successfully avoid, or reduce the effects of, a collision.

: Completion of Module #1; a valid automobile operator's license.

UES: Classroom lecture; Bimodal simulator; Advanced driving range.

ction will be given in a series of submodules:


DAL SIMULATOR
ition #1
Condition #2
D
E
F
G
H
Condition #2
Conditions #1 & #2
M
N
P
Q
R
S
T
Next Module
VANCED DRIVING RANGE
KEY:
= Lecture
= Participation and Practice
= Proficiency Test

threat
on
#1
ndition #1
#2
ndition #2
tration
ition #1-
n #1

M: Advanced Range Test Debriefing, Condition #1
N: Advanced Range Practice, Condition #2
P: Advanced Range Test, Condition #2
Q: Advanced Range Test Debriefing, Condition #2
R: Pre-test Briefing, Advanced Range, Integrated Conditions
S: Advanced Range Test, Integrated Conditions #1 and #2.
T: Advanced Range Test Debriefing, Integrated Conditions #1 & 2

CONDITIONS:
#1 - Intersecting vehicle will impact front half of subject's vehicle, on left or right side, if not successfully avoided.
#2 - Intersecting vehicle will impact rear half of subject's vehicle, on left or right side, if not successfully avoided.

2.7

Prepared By: C.R. Pattarick
Approved By:
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SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 2	② MODULE TITLE: Collision Avoidance; Avoid being struck by intersecting vehicle.
⑦ SUBMODULE NO: 2.A	⑧ SUBMODULE TITLE: Lecture - Intersecting vehicle threat.

⑨ SUBMODULE OBJECTIVES:

(1) To develop in the student a cognizance of the characteristics of the onset conditions and potentially successful response maneuvers for the following conflict situations:

- (a) Intersecting vehicle approaching from left side: will strike left front quarter of subject's car (figure 2.1);
- (b) Intersecting vehicle approaching from right side; will strike right front quarter of subject's car (figure 2.2):
- (c) Intersecting vehicle approaching from left side: will strike left rear quarter of subject's car (figure 2.3);
- (d) Intersecting vehicle approaching from right side; will strike right rear quarter of subject's car (figure 2.4).

(2) To develop in the student a visual image of the characteristics of the onset conditions, multi-vehicle dynamics, and response maneuvers for the above conflict situations.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the four conflict situations w the following obstruction variables*

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lane obstructed;
- (d) Left lane and right lane obstruct
- (e) Subject's lane obstructed straigh

*Obstruction variables are illustrated in fi through 2.20.

⑪ STUDENT MATERIALS: See Table 2-1	⑫ INSTRUCTOR MATERIALS: See Table 2-1	⑬ EVALUATION MATERIALS: See Table 2-1	⑭ SUPPORT R See Table

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ON FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

ollision Avoidance; Avoid being struck by intersecting vehicle.

E:
Lecture - Intersecting vehicle threat.

gnizance of the
onditions and potentially
for the following

aching from left side:
rter of subject's car

aching from right side;
arter of subject's car

aching from left side:
ter of subject's car

aching from right side;
rter of subject's car

sual image of the
onditions, multi-vehicle
rs for the above conflict

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the four conflict situations will include the following obstruction variables* as appropriate:

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left lane and right lane obstructed;
(e) Subject's lane obstructed straight ahead.

*Obstruction variables are illustrated in figures 2.1 through 2.20.

NSTRUCTOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPORT REQUIREMENTS:
ee Table 2-1	See Table 2-1	See Table 2-1

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SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 2	② MODULE TITLE: Collision Avoidance; Avoid being struck by intersecting vehicle.
⑦ SUBMODULE NO: 2.B	⑧ SUBMODULE TITLE: Bimodal Simulator Demonstration; Intersecting vehicle threat.

⑨ SUBMODULE OBJECTIVES:

(1) To familiarize the student with the characteristics of the onset conditions and potentially successful response maneuvers, as they will appear in simulation, for the following conflict situations:

- (a) Intersecting vehicle approaching from left side; will strike left front quarter of subject's car (figure 2.1);
- (b) Intersecting vehicle approaching from right side; will strike right front quarter of subject's car (figure 2.2);
- (c) Intersecting vehicle approaching from left side; will strike left rear quarter of subject's car (figure 2.3);
- (d) Intersecting vehicle approaching from right side; will strike right rear quarter of subject's car (figure 2.4).

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the four conflict situation following obstruction variables* as

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lane obstructed:
- (d) Left lane and right-lane obstru
- (e) Subject's lane obstructed stra

*Obstruction variables are illustrated throught 2.20.

⑪ STUDENT MATERIALS: See Table 2-1	⑫ INSTRUCTOR MATERIALS: See Table 2-1	⑬ EVALUATION MATERIALS: See Table 2-1	⑭ SUPP See

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ICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

LE: Collision Avoidance; Avoid being struck by intersecting vehicle.

TITLE: Bimodal Simulator Demonstration; Intersecting vehicle threat.

t with the characteristics
nd potentially successful
ey will appear in simulation,
t situations:

approaching from left side;
t quarter of subject's car

approaching from right side;
nt quarter of subject's car

approaching from left side;
quarter of subject's car

approaching from right side;
r quarter of subject's car

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the four conflict situations will include the following obstruction variables* as appropriate:

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed:
(d) Left lane and right-lane obstructed:
(e) Subject's lane obstructed straight ahead.

*Obstruction variables are illustrated in figures 2.1 throught 2.20.

⑫ INSTRUCTOR MATERIALS:

See Table 2-1

⑬ EVALUATION MATERIALS:

See Table 2-1

⑭ SUPPORT REQUIREMENTS:

See Table 2-1

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Approved By:

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SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 2	② MODULE TITLE: Collision Avoidance: Avoid being struck by intersecting vehicle
⑦ SUBMODULE NO: 2.C	⑧ SUBMODULE TITLE: Bimodal Simulator Practice; Intersecting vehicle will strike fro of car (Condition #1)

⑨ SUBMODULE OBJECTIVES:

(1) Train student drivers to recognize the onset of these conflict situations at the earliest possible moment;

(a) Intersecting vehicle approaching from left ise; will strike left front quarter of subject's car (figure 2.1);

(b) Intersecting vehicle approaching from right side; will strike right front quarter of subject's car (figure 2.2).

(2) Train student drivers to instantaneously select, from the available choices, the alternative which will most likely avoid, or minimize the effects of, a collision (See Table 2-2).

(3) Train student drivers to effectively implement the alternative selected through evasive maneuvering of their vehicle.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations wil
following obstruction variables*

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left lane and right lane obstru

*Obstruction variables are illustrated in f
through 2.20

⑪ STUDENT MATERIALS: See Table 2-1	⑫ INSTRUCTOR MATERIALS: See Table 2-1	⑬ EVALUATION MATERIALS: See Table 2-1	⑭ SUPPORT See Tabl

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R ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

lision Avoidance: Avoid being struck by intersecting vehicle

modal Simulator Practice; Intersecting vehicle will strike front half
car (Condition #1)

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of subject's car

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quarter of sub-

eously select,
ternative which
e the effects of,

ly implement the
ve maneuvering

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will include the following obstruction variables*

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lane obstructed;
- (d) Left lane and right lane obstructed.

*Obstruction variables are illustrated in figures 2.1 through 2.20

TOR MATERIALS:
le 2-1

⑬ EVALUATION MATERIALS:
See Table 2-1

⑭ SUPPORT REQUIREMENTS:
See Table 2-1

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G. R. Hatterick

Approved
By:

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SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 2	② MODULE TITLE: Collision Avoidance: Avoid being struck by intersecting vehicle
⑦ SUBMODULE NO: 2.D	⑧ SUBMODULE TITLE: Bimodal Simulator Test; Intersecting vehicle will strike fron (Condition #1)

⑨ SUBMODULE OBJECTIVES:

(1) To ascertain that each student has learned to recognize the precursor conditions of these conflict situations as soon as they appear:

- (a) Intersecting vehicle approaching from left side; will strike left front quarter of subjects car (figure 2.1);
- (b) Intersecting vehicle approaching from right side; will strike right front quarter of subject's car (figure 2.2)

(2) To determine that the student has learned to select the most feasible alternative available to either avoid, or reduce the effects of, a collision resulting from this conflict;

(3) To determine that the student has learned to effectively implement the avoidance maneuver selected in this conflict situation.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will
following obstruction variables*

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lane obstructed;
- (d) Left lane and right lane obstruc

*Obstruction variables are illustrated
through 2.20

⑪ STUDENT MATERIALS: See Table 2-1	⑫ INSTRUCTOR MATERIALS: See Table 2-1	⑬ EVALUATION MATERIALS: See Table 2-1	⑭ SUPPO See T

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FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

ollision Avoidance: Avoid being struck by intersecting vehicle

Bimodal Simulator Test; Intersecting vehicle will strike front half of car
(Condition #1)

s learned to recog-
these conflict
:

ning from left side;
r of subjects car

ning from right side;
er of subject's car

s learned to select
ilable to either
a collision re-

s learned to
nce maneuver selected

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will include the following obstruction variables*

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left lane and right lane obstructed.

*Obstruction variables are illustrated in figures 2.1 through 2.20

TRUCTOR MATERIALS:

Table 2-1

⑬ EVALUATION MATERIALS:

See Table 2-1

⑭ SUPPORT REQUIREMENTS:

See Table 2-1

repared
y: G. R. Hatterick

Approved
By:

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SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 2	② MODULE TITLE: Collision Avoidance; Avoid being struck by intersecting vehicle.
⑦ SUBMODULE NO: 2.E	⑧ SUBMODULE TITLE: Bimodal Simulator Test Debriefing; Intersecting vehicle will impa of subject's vehicle if not successfully avoided (Condition #1).

⑨ SUBMODULE OBJECTIVES:

(1) To provide to the student an immediate assessment of the level of performance achieved during the test for the following conflict situations;

- (a) Intersecting vehicle approaching from left side; will strike left front quarter of subject's car (Figure 2.1);
- (b) Intersecting vehicle approaching from right side; will strike right front quarter of subject's car (Figure 2.2).

(2) To provide to the student specific comments regarding deficiencies in performance and the corrective action required, and instances of superior performance.

(3) To gain from the student an immediate appraisal of difficulties encountered and reactions to the test.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will following obstruction variables:*

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lane obstructed;
- (d) Left lane and right lane obstruct

*Obstruction variables are illustrated in f through 2.20

⑪ STUDENT MATERIALS: See Table 2-1	⑫ INSTRUCTOR MATERIALS: See Table 2-1	⑬ EVALUATION MATERIALS: See Table 2-1	⑭ SUPPORT See Table

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ION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

Collision Avoidance; Avoid being struck by intersecting vehicle.

LE: Bimodal Simulator Test Debriefing; Intersecting vehicle will impact front half
vehicle if not successfully avoided (Condition #1).

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hieved during the test
uations;

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rter of subject's car

aching from right side;
arter of subject's car

ific comments
ormance and the
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mediate appraisal
d reactions to the

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will include the following obstruction variables:*

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lane obstructed:
- (d) Left lane and right lane obstructed.

*Obstruction variables are illustrated in figures 2.1 through 2.20

NSTRUCTOR MATERIALS:

e Table 2-1

⑬ EVALUATION MATERIALS:

See Table 2-1

⑭ SUPPORT REQUIREMENTS:

See Table 2-1

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By: G. R. Hatterick

Approved
By:

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SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 2	② MODULE TITLE: Collision Avoidance; Avoid being struck by intersecting vehicle.
⑦ SUBMODULE NO: 2.F	⑧ SUBMODULE TITLE: Bimodal Simulator Practice; Intersecting vehicle will strike rear h subject's car (Condition #2)

⑨ SUBMODULE OBJECTIVES:

(1) Train stduent drivers to recognize the onset of these conflict situations at the earliest possible moment:

- (a) Intersecting vehicle approaching from left side; will strike left rear quarter of subject's car (figure 2.3);
- (b) Intersecting vehicle approaching from right side; will strike right rear quarter of subject's car (figure 2.4).

(2) Train student drivers to instantaneously select, from the available choices, the alternative which will most likely avoid or minimize the effects of a collision (See Table 2-2).

(3) Train student drivers to effectively implement the alternative selected through evasive maneuvering of their vehicle.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will i
following obstruction variables* as ap

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lane obstructed;
- (d) Left lane and right lane obstructe
- (e) Subject's lane obstructed straight

*Obstruction variables are illustrated in fig
through 2.20

⑪ STUDENT MATERIALS: See Table 2-1	⑫ INSTRUCTOR MATERIALS: See Table 2-1	⑬ EVALUATION MATERIALS: See Table 2-1	⑭ SUPPORT RE See Table

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FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

ollision Avoidance; Avoid being struck by intersecting vehicle.

Bimodal Simulator Practice; Intersecting vehicle will strike rear half of subject's car (Condition #2)

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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will include the following obstruction variables* as appropriate:

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lane obstructed;
- (d) Left lane and right lane obstructed;
- (e) Subject's lane obstructed straight ahead.

*Obstruction variables are illustrated in figures 2.1 through 2.20

STRUCTOR MATERIALS: ee Table 2-1	⑬ EVALUATION MATERIALS: See Table 2-1	⑭ SUPPORT REQUIREMENTS: See Table 2-1

Prepared
By: G. R. Hatterick

Approved
By:

① MODULE NO: 2	② MODULE TITLE: Collision Avoidance; Avoid being struck by intersecting vehicle.
⑦ SUBMODULE NO: 2.G	⑧ SUBMODULE TITLE: Bimodal Simulator Test, Intersecting vehicle will strike rear ha car (Condition #2)

⑨ SUBMODULE OBJECTIVES:

(1) To ascertain that each student has learned to recognize the precursor conditions of these conflict situations as soon as they appear;

- (a) Intersecting vehicle approaching from left side; will strike left rear quarter of subject's car (figure 2.3);
- (b) Intersecting vehicle approaching from right side; will strike right rear quarter of subject's car (figure 2.4).

(2) To determine that the student has learned to select the most feasible alternative available to either avoid, or reduce the effects of, a collision resulting from this conflict;

(3) To determine that the student has learned to effectively implement the avoidance maneuver selected in this conflict situation.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations wil
following obstruction variables;* a

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lane obstructed;
- (d) Left lane and right lane obstr
- (e) Subject's lane obstructed stra

*Obstruction variables are illustrated i
2.1 through 2.20

⑪ STUDENT MATERIALS:	⑫ INSTRUCTOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPORT
See Table 2-1	See Table 2-1	See Table 2-1	See Tab

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PF-0530-1/2 (a)

CATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

LE:
Collision Avoidance; Avoid being struck by intersecting vehicle.

TITLE: Bimodal Simulator Test, Intersecting vehicle will strike rear half of car (Condition #2)

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appear;

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quarter of subject's car

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ts of, a collision re-
;

ent has learned to
avoidance maneuver selected
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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will include the following obstruction variables* as appropriate:

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left lane and right lane obstructed;
(e) Subject's lane obstructed straight ahead.

*Obstruction variables are illustrated in figures 2.1 through 2.20

INSTRUCTOR MATERIALS:

See Table 2-1

⑬ EVALUATION MATERIALS:

See Table 2-1

⑭ SUPPORT REQUIREMENTS:

See Table 2-1

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Approved By:

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SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 2

② MODULE TITLE: Collision Avoidance; Avoid being struck by intersecting vehicle.

⑦ SUBMODULE NO: 2.H

⑧ SUBMODULE TITLE: Bimodal Simulator Test Debriefing; Intersecting vehicle will impa
of subject's vehicle if not successfully avoided (Condition #2)

⑨ SUBMODULE OBJECTIVES:

(1) To provde to the student an immediate assessment of the level of performance achieved during the test for the following conflict situations:
   (a) Intersecting vehicle approaching from left side; will strike left rear quarter of subject's car (figure 2.3);
   (b) Intersecting vehicle approaching from right side; will strike right rear quarter of subject's car (figure 2.4).

(2) To provide to the student specific comments regarding deficiencies in performance and the corrective action required, and instances of superior performance.

(3) To gain from the student an immediate appraisal of difficulties encountered and reactions to the test.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations wil
following obstruction variables,* as
   (a) No obstructions;
   (b) Left lane obstructed;
   (c) Right lane obstructed;
   (d) Left lane and right lane obstru
   (e) Subject's lane obstructed strai

*Obstruction variables are illustrated in
through 2.20

⑪ STUDENT MATERIALS: See Table 2-1

⑫ INSTRUCTOR MATERIALS: See Table 2-1

⑬ EVALUATION MATERIALS: See Table 2-1

⑭ SUPPORT

See Tab

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TION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

:
Collision Avoidance; Avoid being struck by intersecting vehicle.

TLE: Bimodal Simulator Test Debriefing; Intersecting vehicle will impact rear half
vehicle if not successfully avoided (Condition #2)

immediate assessment
achieved during the
ict situations:

proaching from left side;
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quarter of subject's car

pecific comments
erformance and the
and instances of superior

immediate appraisal
and reactions to the

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will include the following obstruction variables,* as appropriate:

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left lane and right lane obstructed;
(e) Subject's lane obstructed straight ahead.

*Obstruction variables are illustrated in figures 2.1 through 2.20

INSTRUCTOR MATERIALS: See Table 2-1	⑬ EVALUATION MATERIALS: See Table 2-1	⑭ SUPPORT REQUIREMENTS: See Table 2-1

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① MODULE NO: 2

② MODULE TITLE: Collision Avoidance; Avoid being struck by intersecting vehicle

⑦ SUBMODULE NO: 2.J

⑧ SUBMODULE TITLE: Advanced Driving Range Demonstration; Intersecting vehicle threa

⑨ SUBMODULE OBJECTIVES:

(1) To familiarize the student with the characteristics of the onset conditions and potentially successful response maneuvers, as they will appear on the driving range, for the following conflict situations.

- (a) Intersecting vehicle approaching from left side; will strike left front quarter of subjects car (figure 2.1);
- (b) Intersecting vehicle approaching from right side; will strike right front quarter of subject's car (figure 2.2);
- (c) Intersecting vehicle approaching from left side; will strike left rear quarter of subject's car (figure 2.3);
- (d) Intersecting vehicle approaching from right side; will strke right rear quarter of subject's car (figure 2.4).

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the four conflict situations following obstruction variables* as

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lance obstructed;
- (d) Left lane and right lane obstruc
- (e) Subject's lane obstructed straig

(2) Only student participants and requir staff will be permitted on the range submodule.

(3) All range safety equipment and proce verified prior to initiating demonst student practice sessions.

(4) Range Safety Monitor must be on duty during the use of the range.

*Obstruction variables are illustrated in through 2.20.

⑪ STUDENT MATERIALS:

See Table 2-1

⑫ INSTRUCTOR MATERIALS:

See Table 2-1

⑬ EVALUATION MATERIALS:

See Table 2-1

⑭ SUPPORT

See Tab

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ATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

E: Collision Avoidance; Avoid being struck by intersecting vehicle

ITLE: Advanced Driving Range Demonstration; Intersecting vehicle threat.

with the characteristics
d potentially successful
y will appear on the
lowing conflict situations.

pproaching from left side;
quarter of subjects car

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t quarter of subject's car

pproaching from left side;
quarter of subject's car

pproaching from right side;
quarter of subject's car

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the four conflict situations will include the following obstruction variables* as appropriate;

- (a) No obstructions;
- (b) Left lane obstructed:
- (c) Right lance obstructed:
- (d) Left lane and right lane obstructed:
- (e) Subject's lane obstructed straight ahead.

(2) Only student participants and required instructor staff will be permitted on the range during this submodule.

(3) All range safety equipment and procedures will be verified prior to initiating demonstration and/or student practice sessions.

(4) Range Safety Monitor must be on duty at all times during the use of the range.

*Obstruction variables are illustrated in figures 2.1 through 2.20.

INSTRUCTOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPORT REQUIREMENTS:
See Table 2-1	See Table 2-1	See Table 2-1

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① MODULE NO:
2

② MODULE TITLE:
Collision Avoidance; Avoid being struck by intersecting vehicle.

⑦ SUBMODULE NO:
2.K

⑧ SUBMODULE TITLE: Advanced Driving Range Practice; Intersecting vehicle will stri
of car (Condition #1).

⑨ SUBMODULE OBJECTIVES:

(1) Train student drivers to recognize the onset of these conflict situations at the earliest possible moment:

(a) Intersecting vehicle approaching from left side; will strike left front quarter of subjects car (figure 2.1);
(b) Intersecting vehicle approaching from right side: will strike right front quarter of subject's car (figure 2.2).

(2) Train student drivers to instantaneously select, from the available choices, the alternative which will most likely avoid, or minimize the effects of, a collision (See Table 2-2).

(3) Train student drivers to effectively implement the alternative selected through evasive maneuvering of their vehicle.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Only student participants and requ
staff will be permitted on the ran
submodule.

(2) All range safety equipment and pro
verified prior to initiating stude
sessions.

(3) Range Safety Monitor must be on du
during the use of the range.

(4) Each of the conflict situations wi
following obstruction variables:*

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left lane and right lane obstr

*Obstruction variables are illustrated in
through 2.20

⑪ STUDENT MATERIALS:
See Table 2-1

⑫ INSTRUCTOR MATERIALS:
See Table 2-1

⑬ EVALUATION MATERIALS:
See Table 2-1

⑭ SUPPOR
See

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Approved By:

PF-0530-1/2 (a)

ATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

E: Collision Avoidance; Avoid being struck by intersecting vehicle.

ITLE: Advanced Driving Range Practice: Intersecting vehicle will strike front half of car (Condition #1)

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earliest possible moment:

pproaching from left side;
quarter of subjects car

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quarter of subject's car

nstantaneously select, from
alternative which will
mize the effects of, a

ffectively implement the
gh evasive maneuvering

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Only student participants and required instructor staff will be permitted on the range during this submodule.

(2) All range safety equipment and procedures will be verified prior to initiating student practice sessions.

(3) Range Safety Monitor must be on duty at all times during the use of the range.

(4) Each of the conflict situations will include the following obstruction variables:*

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left lane and right lane obstructed.

*Obstruction variables are illustrated in figures 2.1 through 2.20

) INSTRUCTOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPORT REQUIREMENTS:
See Table 2-1	See Table 2-1	See Table 2-1

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SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 2

② MODULE TITLE: Collision Avoidance Test; Avoid being struck by intersecting vehicle

⑦ SUBMODULE NO: 2.L

⑧ SUBMODULE TITLE: Advanced Driving Range Test; Intersecting vehicle will strike fr
car (Condtion #1)

⑨ SUBMODULE OBJECTIVES:

(1) To ascertain that each student has learned to recognize the precursor conditions of these conflict situations as soon as they appear;

(a) Intersecting vehicle approaching from left side; will strike left front quarter of subject's car (figure 2.1);

(b) Intersecting vehicle approaching from right side; will strike right front quarter of subject's car (figure 2.2)

(2) To determine that the student has learned to select the most feasible alternative available to either avoid, or reduce the effects of, a collision resulting from this conflict;

(3) To determine that the student has learned to effectively implement the avoidance maneuver selected in this conflict situation.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Only student participants and requi
staff will be permitted on the range
submodule.

(2) All range safety equipment and proc
verified prior to initiating studen
sessions.

(3) Range Safety Monitor must be on dut
during the use of the range.

(4) Each of the conflict situations wil
following obstruction variables: *

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left lane and right lane obstru

*Obstruction variables are illustrated in f
through 2.20

⑪ STUDENT MATERIALS: See Table 2-1

⑫ INSTRUCTOR MATERIALS: See Table 2-1

⑬ EVALUATION MATERIALS: See Table 2-1

⑭ SUPPORT
See T

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Prepared By: G. R. Hatterick

Approved By:

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FICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

ITLE: Collision Avoidance Test; Avoid being struck by intersecting vehicle

E TITLE: Advanced Driving Range Test; Intersecting vehicle will strike front half of car (Condtion #1)

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conditions of these conflict
ey appear;

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ont quarter of subject's car

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udent has learned to
e avoidance maneuver
t situation.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Only student participants and required instructor staff will be permitted on the range during this submodule.

(2) All range safety equipment and procedures will be verified prior to initiating student test sessions.

(3) Range Safety Monitor must be on duty at all times during the use of the range.

(4) Each of the conflict situations will include the following obstruction variables: *

  (a) No obstructions;
  (b) Left lane obstructed;
  (c) Right lane obstructed;
  (d) Left lane and right lane obstructed.

*Obstruction variables are illustrated in figures 2.1 through 2.20

⑫ INSTRUCTOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPORT REQUIREMENTS:
See Table 2-1	See Table 2-1	See Table 2-1

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① MODULE NO: 2

② MODULE TITLE: Collision Avoidance; Avoid being struck by intersecting vehicle.

⑦ SUBMODULE NO: 2.M

⑧ SUBMODULE TITLE: Advanced Driving Range Test Debriefing; Intersecting vehicle wi
half of subject's vehicle if not successfully avoided (Condition #1).

⑨ SUBMODULE OBJECTIVES:

(1) To provide to the student an immediate assessment of the level of performance achieved during the test, for the following conflict situations:

- (a) Intersecting vehicle approaching from left side; will strike left front quarter of subject's car (figure 2.1);
- (b) Intersecting vehicle approaching from right side; will strike right front quarter of subject's car (figure 2.2)

(2) To provide to the student specific comments regarding deficiencies in performance and the corrective action required, and instances of superior performance.

(3) To gain from the student an immediate appraisal of difficulties encountered and reactions to the test.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations wi
following obstruction variables: *

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lane obstructed;
- (d) Left lane and right lane obstr

*Obstruction variables are illustrated in
through 2.20

⑪ STUDENT MATERIALS:	⑫ INSTRUCTOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPOR
See Table 2-1	See Table 2-1	See Table 2-1	See T

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FICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

ITLE: Collision Avoidance; Avoid being struck by intersecting vehicle.

E TITLE: Advanced Driving Range Test Debriefing; Intersecting vehicle will impact front subject's vehicle if not successfully avoided (Condition #1).

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conflict situations:

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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will include the following obstruction variables: *

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left lane and right lane obstructed.

*Obstruction variables are illustrated in figures 2.1 through 2.20

⑫ INSTRUCTOR MATERIALS:

See Table 2-1

⑬ EVALUATION MATERIALS:

See Table 2-1

⑭ SUPPORT REQUIREMENTS:

See Table 2-1

SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 2	② MODULE TITLE: Collision Avoidance; Avoid being struck by intersecting vehicle.
⑦ SUBMODULE NO: 2.N	⑧ SUBMODULE TITLE: Advanced Driving Range Practice; Intersecting vehicle will stri half of car (Condition #2)

⑨ SUBMODULE OBJECTIVES:

(1) Train student drivers to recognize the onset of these conflict situations at the earliest possible moment;

  (a) Intersecting vehicle approaching from left side; will strike left rear quarter of subject's car (figure 2.3);

  (b) Intersecting vehicle approaching from right side; will strike right rear quarter of subject's car (figure 2.4).

(2) Train student drivers to instantaneously select, from the available choices, the alternative which will most likely avoid, or minimize the effects of, a collision (See Table 2-2).

(3) Train student drivers to effectively implement the alternative selected through evasive maneuvering of their vehicle.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Only student participants and requ
staff will be permitted on the ran
submodule.

(2) All range safety equipment and pro
verified prior to initiating stude
sessions.

(3) Range Safety Monitor must be on du
during the use of the range.

(4) Each of the conflict situations wi
following obstruction variables:*

  (a) No obstructions;
  (b) Left lane obstructed;
  (c) Right lane obstructed;
  (d) Left lane and right lane obst
  (e) Subject's lane obstructed stra

*Obstruction variables are illustrated i
through 2.20

⑪ STUDENT MATERIALS: See Table 2-1	⑫ INSTRUCTOR MATERIALS: See Table 2-1	⑬ EVALUATION MATERIALS: See Table 2-1	⑭ SUPPO See

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FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

llision Avoidance; Avoid being struck by intersecting vehicle.

Advanced Driving Range Practice; Intersecting vehicle will strike rear half of car (Condition #2)

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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Only student participants and required instructor staff will be permitted on the range during this submodule.

(2) All range safety equipment and procedures will be verified prior to initiating student practice sessions.

(3) Range Safety Monitor must be on duty at all times during the use of the range.

(4) Each of the conflict situations will include the following obstruction variables:*

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left lane and right lane obstructed ;
(e) Subject's lane obstructed straight ahead.

*Obstruction variables are illustrated in figures 2.1 through 2.20

TRUCTOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPORT REQUIREMENTS:
Table 2-1	See Table 2-1	See Table 2-1

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SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 2	② MODULE TITLE: Collision Avoidance; Avoid being struck by intersecting vehicle.
⑦ SUBMODULE NO: 2.P	⑧ SUBMODULE TITLE: Advanced Driving Range Test; Intersecting vehicle will strike car (Condition #2)

⑨ SUBMODULE OBJECTIVES:

(1) To ascertain that each student has learned to recognize the precursor conditions of these conflict situations as soon as they appear;

  (a) Intersecting vehicle approaching from left side; will strike left rear quarter of subject's car (Figure 2.3);
  (b) Intersecting vehicle approaching from right side; will strike right rear quarter of subject's car (Figure 2.4);

(2) To determine that the student has learned to select the most feasible alternative available to either avoid, or reduce the effects of, a collision resulting from this conflict;

(3) To determine that the student has learned to effectively implement the avoidance maneuver selected in this conflict situation.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Only student participants and requ staff will be permitted on the ran submodule.

(2) All range safety equipment and pro verified prior to initiating stude sessions.

(3) Range Safety Monitor must be on du during the use of the range.

(4) Each of the conflict situations wi following obstruction variables:*

  (a) No obstructions;
  (b) Left lane obstructed;
  (c) Right lane obstructed;
  (d) Left lane and right lane obstr

*Obstruction variables are illustrated in through 2.20

⑪ STUDENT MATERIALS: See Table 2-1	⑫ INSTRUCTOR MATERIALS: See Table 2-1	⑬ EVALUATION MATERIALS: See Table 2-1	⑭ SUPPOR See

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FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

llision Avoidance; Avoid being struck by intersecting vehicle.

Advanced Driving Range Test; Intersecting vehicle will strike rear half of car (Condition #2)

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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Only student participants and required instructor staff will be permitted on the range during this submodule.

(2) All range safety equipment and procedures will be verified prior to initiating student test sessions.

(3) Range Safety Monitor must be on duty at all times during the use of the range.

(4) Each of the conflict situations will include the following obstruction variables:*

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lane obstructed;
- (d) Left lane and right lane obstructed.

*Obstruction variables are illustrated in figures 2.1 through 2.20

TRUCTOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPORT REQUIREMENTS:
Table 2-1	See Table 2-1	See Table 2-1

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SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 2

② MODULE TITLE: Collision Avoidance; Avoid being struck by intersecting vehicle.

⑦ SUBMODULE NO: 2.Q

⑧ SUBMODULE TITLE: Advanced Driving Range Test Debriefing; Intersecting vehicle will half of subject's vehicle if not successfully avoided (Condition #2)

⑨ SUBMODULE OBJECTIVES:

(1) To provide to the student an immediate assessment of the level of performance achieved during the test, for the following conflicts:
   (a) Intersecting vehicle approaching from left side; will strike left rear quarter of subject's car (figure 2.3);
   (b) Intersecting vehicle approaching from right side; will strike right rear quarter of subject's car (figure 2.4).

(2) To provide to the student specific comments regarding deficiencies in performance and the corrective action required, and instances of superior performance;

(3) To gain from the student an immediate appraisal of difficulties encountered and reactions to the test.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations wil following obstruction variables* as
   (a) No obstructions;
   (b) Left lane obstructed;
   (c) Right lane obstructed;
   (d) Left lane and right lane obstru
   (e) Subject's lane obstructed strai

*Obstruction variables are illustrated in fi through 2.20

⑪ STUDENT MATERIALS: See Table 2-1

⑫ INSTRUCTOR MATERIALS: See Table 2-1

⑬ EVALUATION MATERIALS: See Table 2-1

⑭ SUPPORT See Tab

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FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

llision Avoidance; Avoid being struck by intersecting vehicle.

dvanced Driving Range Test Debriefing; Intersecting vehicle will impact rear
vehicle if not successfully avoided (Condition #2)

iate assessment
ed during the

ng from left side;
of subject's car

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of subject's car

comments regarding
e corrective action
r performance;

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actions to the

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will include the following obstruction variables* as appropriate:

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lane obstructed;
- (d) Left lane and right lane obstructed;
- (e) Subject's lane obstructed straight ahead.

*Obstruction variables are illustrated in figures 2.1 through 2.20

UCTOR MATERIALS: Table 2-1	⑬ EVALUATION MATERIALS: See Table 2-1	⑭ SUPPORT REQUIREMENTS: See Table 2-1

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① MODULE NO: 2

② MODULE TITLE: Collision Avoidance; Avoid being struck by intersecting vehicle.

⑦ SUBMODULE NO: 2.R

⑧ SUBMODULE TITLE: Pre-Test Briefing, Advanced Driving Range Test; Intersecting vehi
either the front half (Condition #1) or rear half (Condition #2) of the subjects v

⑨ SUBMODULE OBJECTIVES:

(1) To prepare the student for conduct of the integrated testing submodule by describing the scope of the test, reviewing the characteristics of the included conflict situations, and describing the maneuvers most likely to be successful for the following conflict situations:
   - (a) Intersecting vehicle approaching from left side; will strike left front quarter of subject's car (figure 2.1);
   - (b) Intersecting vehicle approaching from right side; will strike right front quarter of subject's car (figure 2.2);
   - (c) Intersecting vehicle approaching from left side; will strike left rear quarter of subject's car (figure 2.3);
   - (d) Intersecting vehicle approaching from right side; will strike right rear quarter of subject's car (figure 2.4).

(2) To assure that the student comprehends the need to select the most appropriate course of evasive action based on the specific characteristics of the conflict situations confronting him.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations wil
following obstruction variables,* as
   - (a) No obstructions;
   - (b) Left lane obstructed;
   - (c) Right lane obstructed;
   - (d) Left lane and right lane obstru
   - (e) Subject's lane obstructed stra

*Obstruction variables are illustrated in
through 2.20

⑪ STUDENT MATERIALS:	⑫ INSTRUCTOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPORT
See Table 2-1	See Table 2-1	See Table 2-1	See Ta

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R ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

ision Avoidance; Avoid being struck by intersecting vehicle.

e-Test Briefing, Advanced Driving Range Test; Intersecting vehicle may strike
lf (Condition #1) or rear half (Condition #2) of the subjects vehicle.

of the integrated
scope of the test,
e included conflict
euvers most likely t
nflict situations:
ng from left side;
of subject's car

ng from right side;
r of subject's car

ng from left side;
of subject's car

ng from right side;
of subject's car

ends the need to
of evasive
cteristics of
g him.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will include the following obstruction variables,* as appropriate:

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lane obstructed;
- (d) Left lane and right lane obstructed;
- (e) Subject's lane obstructed straight ahead.

*Obstruction variables are illustrated in figures 2.1 through 2.20

RUCTOR MATERIALS:

Table 2-1

⑬ EVALUATION MATERIALS:

See Table 2-1

⑭ SUPPORT REQUIREMENTS:

See Table 2-1

epared
: G. R. Hatterick

Approved
By:

SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 2

② MODULE TITLE: Collision Avoidance; Avoid being struck by intersecting vehicle.

⑦ SUBMODULE NO: 2.S

⑧ SUBMODULE TITLE: Integrated Advanced Range Test; Intersecting vehicle may strike e front half (Condition #1) or the rear half (Condition #2) of the subject's car.

⑨ SUBMODULE OBJECTIVES:

(1) To ascertain that each student has learned to recognize the precursor conditions of these conflict situations as soon as they appear:

- (a) Intersecting vehicle approaching from left side; will strike left front quarter of subject's car (figure 2.1);
- (b) Intersecting vehicle approaching from right side: will strike right front quarter of subject's car (figure 2.2);
- (c) Intersecting vehicle approaching from left side: will strike left rear quarter of subject's car (figure 2.3);
- (d) Intersecting vehicle approaching from right side: will strike right rear quarter of subject's car (figure 2.4);

(2) To determine that the student has learned to select the most feasible alternative available to either avoid, or reduce the effects of, a collision resulting from this conflict;

(3) To determine that the student has learned to effectively implement the avoidance maneuver selected in this conflict situation.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Only student participants and requir staff will be permitted on the range submodule.

(2) All range safety equipment and proce verified prior to initiating student sessions.

(3) Range Safety Monitor must be on duty during the use of the range.

(4) Each of the conflict situations will following obstruction variables: *

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lane obstructed;
- (d) Left lane and right lane obstruc
- (e) Subject's lane obstructed straig

*Obstruction variables are illustrated in f through 2.20

⑪ STUDENT MATERIALS: See Table 2-1

⑫ INSTRUCTOR MATERIALS: See Table 2-1

⑬ EVALUATION MATERIALS: See Table 2-1

⑭ SUPPORT See T

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Approved By:

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N FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

ollision Avoidance; Avoid being struck by intersecting vehicle.

: Integrated Advanced Range Test; Intersecting vehicle may strike either the
ndition #1) or the rear half (Condition #2) of the subject's car.

has learned to recog-
of these conflict
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aching from left side;
rter of subject's car

aching from right side:
arter of subject's car

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aching from right side:
rter of subject's car

has learned to select
available to either
f, a collision re-

has learned to
dance maneuver selected

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Only student participants and required instructor staff will be permitted on the range during this submodule.

(2) All range safety equipment and procedures will be verified prior to initiating student test sessions.

(3) Range Safety Monitor must be on duty at all times during the use of the range.

(4) Each of the conflict situations will include the following obstruction variables: *

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lane obstructed;
- (d) Left lane and right lane obstructed.
- (e) Subject's lane obstructed straight ahead.

*Obstruction variables are illustrated in figures 2.1 through 2.20

STRUCTOR MATERIALS:

ee Table 2-1

⑬ EVALUATION MATERIALS:

See Table 2-1

⑭ SUPPORT REQUIREMENTS:

See Table 2-1

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SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 2

② MODULE TITLE: Collision Avoidance; Avoid being struck by intersecting vehicle.

⑦ SUBMODULE NO: 2.T

⑧ SUBMODULE TITLE: Integrated Advanced Driving Range Test Debriefing; Intersecting ve either front half (Condition #1) or rear half (Condition #2) of subject's vehicle.

⑨ SUBMODULE OBJECTIVES:

(1) To provide to the student an immediate assessment of the level of performance achieved during the test, for the following conflicts:

  (a) Intersecting vehicle approaching from left side; will strike left front quarter of subject's car (figure 2.1);
  (b) Intersecting vehicle approaching from right side; will strike right front quarter of subject's car (figure 2.2);
  (c) Intersecting vehicle approaching from left side; will strike left rear quarter of subject's car (figure 2.3);
  (d) Intersecting vehicle approaching from right side; will strike right rear quarter of subject's car (figure 2.4).

(2) To provide to the student specific comments regarding deficiencies in performance and the corrective action required, and instances of superior performance.

(3) To gain from the student an immediate appraisal of difficulties encountered and reactions to the test.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the four conflict situations w the following obstruction variables* a

  (a) No obstructions;
  (b) Left lane obstructed;
  (c) Right lane obstructed;
  (d) Left lane and right lane obstructe
  (e) Subject's lane obstructed straigh

*Obstruction variables are illustrated in f through 2.20

⑪ STUDENT MATERIALS:	⑫ INSTRUCTOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPORT
See Table 2-1	See Table 2-1	See Table 2-1	See Tabl

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N FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

ollision Avoidance: Avoid being struck by intersecting vehicle.

: Integrated Advanced Driving Range Test Debriefing; Intersecting vehicle will impact
lf (Condition #1) or rear half (Condition #2) of subject's vehicle.

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ter of subject's car

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rter of subject's car

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er of subject's car

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ter of subject's car

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rmance and the
instances of

ediate appraisal
reactions to the

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the four conflict situations will include the following obstruction variables* as appropriate:

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left lane and right lane obstructed;
(e) Subject's lane obstructed straight ahead.

*Obstruction variables are illustrated in figures 2.1 through 2.20

STRUCTOR MATERIALS:

e Table 2-1

⑬ EVALUATION MATERIALS:

See Table 2-1

⑭ SUPPORT REQUIREMENTS:

See Table 2-1

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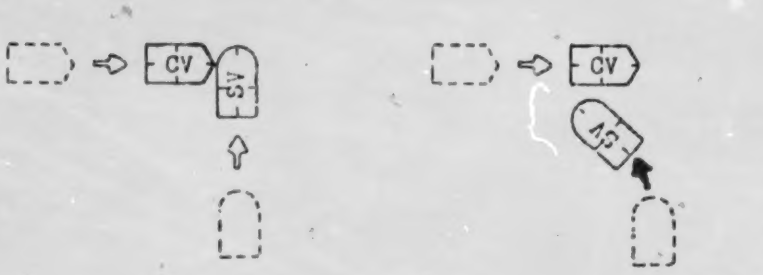
① MODULE NO: 2	② MODULE TITLE: Collision Avoidance; Avoid being struck by intersecting vehicle

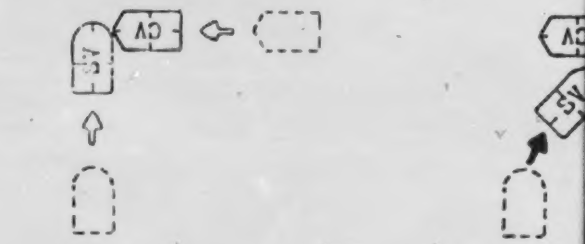
Figure 2.1: Intersecting vehicle threat to left front quarter of subject's vehicle; no obstructions.



(a) No avoidance response.

(b) Best chance: Brake and steer left.

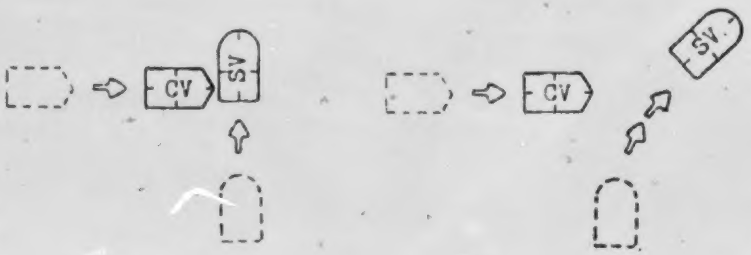
Figure 2.2: Intersecting vehicle threat to r
quarter of subject's vehicle; no



(a) No avoidance response.

(b) Best cha
steer ri

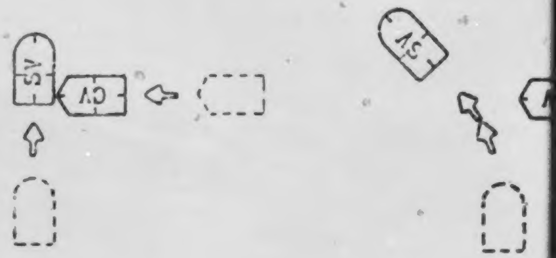
Figure 2.3: Intersecting vehicle threat to left rear quarter of subject's vehicle; no obstructions.



(a) No avoidance response.

(b) Best chance: Accelerate and steer right.

Figure 2.4: Intersecting vehicle threat to r
quarter of subject's vehicle; no



(a) No avoidance response.

(b) Best chanc
and steer

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Collision Avoidance; Avoid being struck by intersecting vehicle

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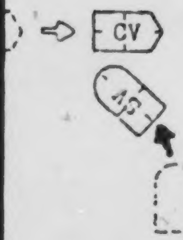
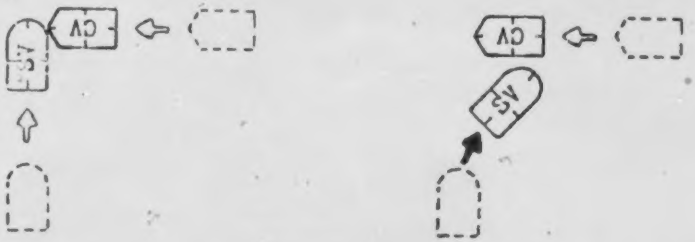
icle; no obstructions.



st chance: Brake and
eer left.

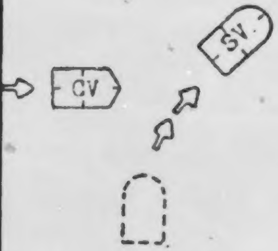
Figure 2.2: Intersecting vehicle threat to right front quarter of subject's vehicle; no obstructions.



(a) No avoidance response.

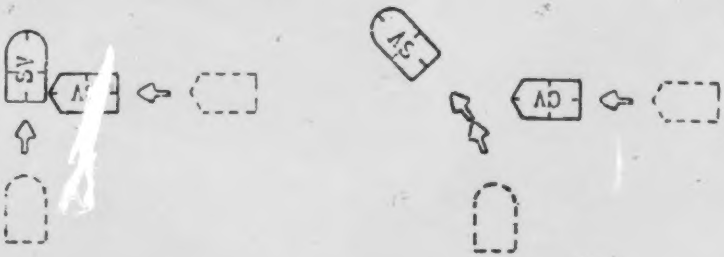
(b) Best chance: Brake and steer right.

at to left rear
cle; no obstructions.



est chance: Accelerate
nd steer right.

Figure 2.4: Intersecting vehicle threat to right rear quarter of subject's vehicle; no obstructions.

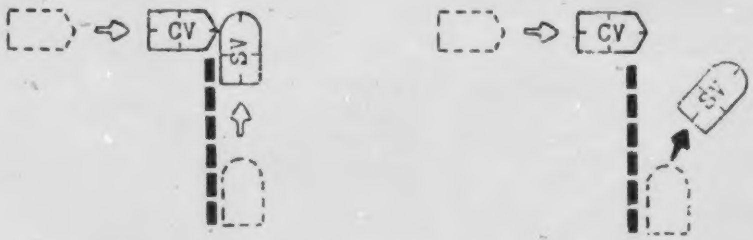


(a) No avoidance response.

(b) Best chance: Accelerate and steer left.

① MODULE NO: 2	② MODULE TITLE: Collision Avoidance; Avoid being struck by intersecting vehicle

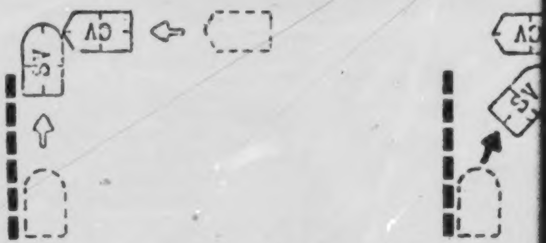
Figure 2.5: Intersecting vehicle threat to left front quarter of subject's vehicle; left lane obstructed.



(a) No avoidance response

(b) Best chance: Brake and steer right.

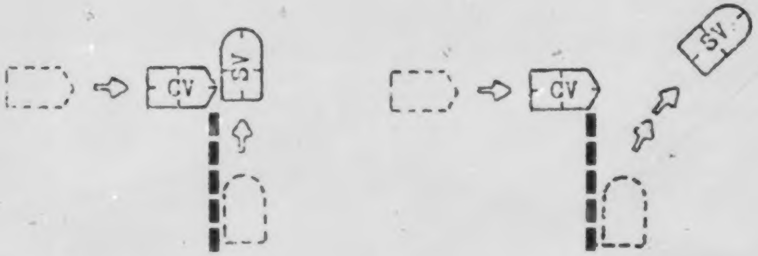
Figure 2.6: Intersecting vehicle threat
quarter of subject's vehicle
obstructed.



(a) No avoidance response

(b) Best ch
steer r

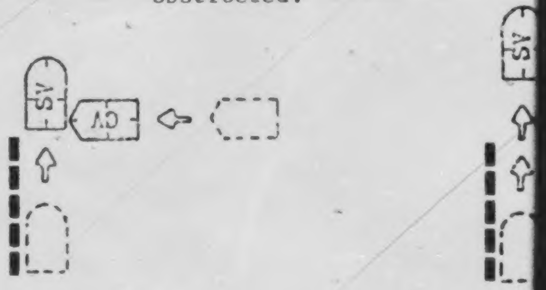
Figure 2.7: Intersecting vehicle threat to left rear quarter of subject's vehicle; left lane obstructed.



(a) No avoidance response.

(b) Best chance: Accelerate and steer right.

Figure 2.8: Intersecting vehicle threat
quarter of subject's vehicle
obstructed.



(a) No avoidance response.

(b) Best
strai

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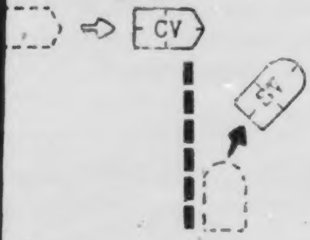
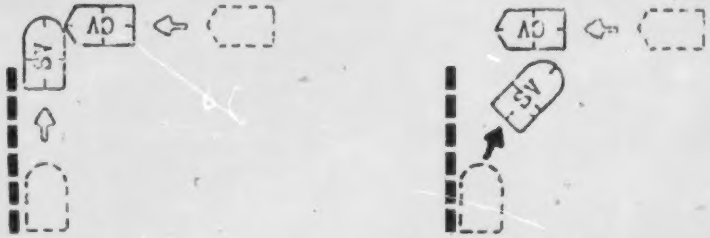
Collision Avoidance; Avoid being struck by intersecting vehicle

threat to left front
vehicle; left lane



Best chance: Brake and
steer right.

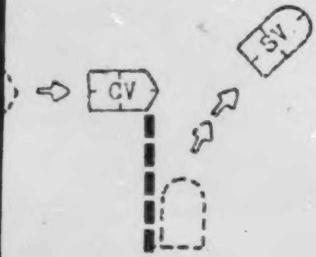
Figure 2.6: Intersecting vehicle threat to right front quarter of subject's vehicle; left lane obstructed.



(a) No avoidance response

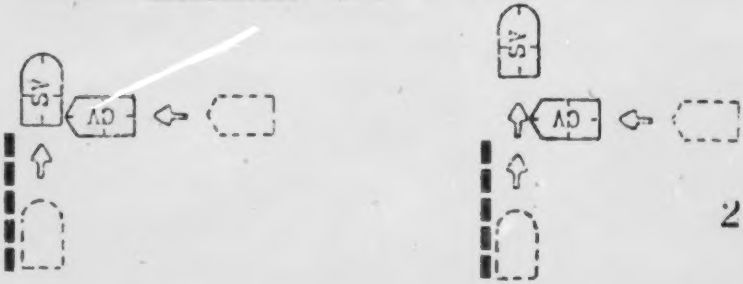
(b) Best chance: Brake and steer right.

threat to left rear
vehicle; left lane



) Best chance: Accelerate
and steer right.

Figure 2.8: Intersecting vehicle threat to right rear quarter of subject's vehicle; left lane obstructed.

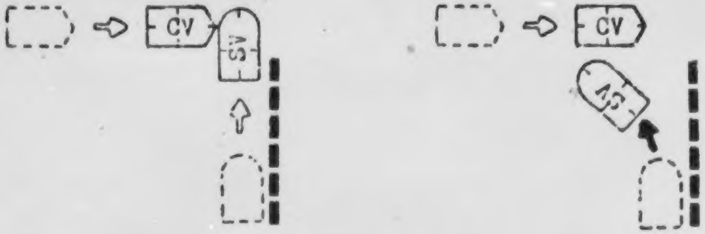


(a) No avoidance response.

(b) Best chance: Accelerate straight ahead

① MODULE NO: 2	② MODULE TITLE: Collision Avoidance; Avoid being struck by intersecting vehicle

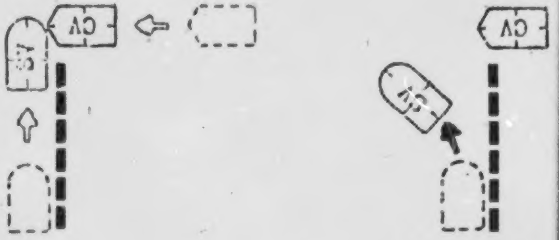
Figure 2.9: Intersecting vehicle threat to left front quarter of subject's vehicle; right lane obstructed.



(a) No avoidance response.

(b) Best chance: Brake and Steer left.

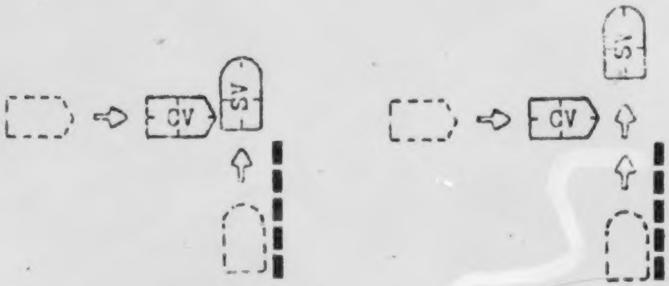
Figure 2.10: Intersecting vehicle threat to quarter of subject's vehicle; obstructed.



(a) No avoidance response.

(b) Best chan steer lef

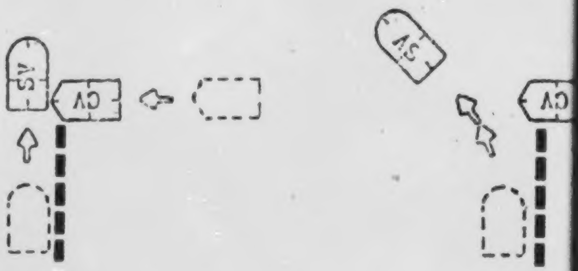
Figure 2.11: Intersecting vehicle threat to left rear quarter of subject's vehicle; right lane obstructed.



(a) No avoidance response.

(b) Best chance: Accelerate straight ahead.

Figure 2.12: Intersecting vehicle threat to quarter of subject's vehicle; obstructed.



(a) No avoidance response.

(b) Best cha and stee

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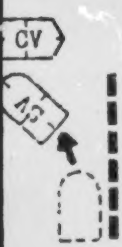
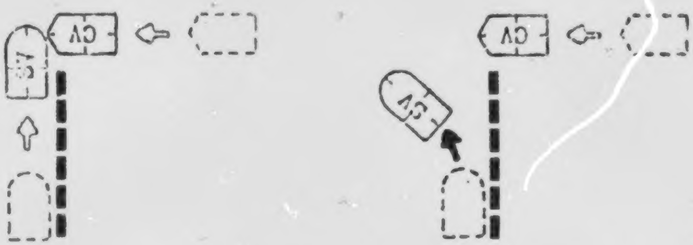
ion Avoidance; Avoid being struck by intersecting vehicle

left front
right lane



ance: Brake and
eft.

Figure 2.10: Intersecting vehicle threat to right front quarter of subject's vehicle; right lane obstructed.



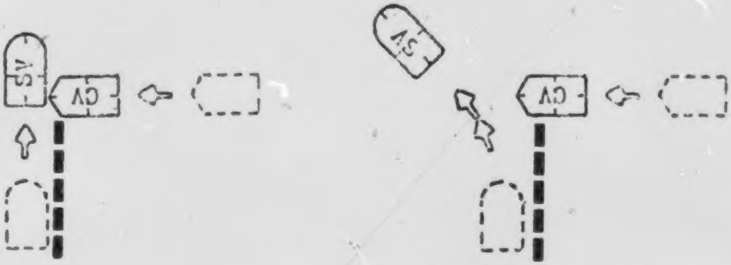
(a) No avoidance response.

(b) Best chance: Brake and steer left.

to left rear
; right lane

ance: Accelerate
t ahead.

Figure 2.12: Intersecting vehicle threat to right rear quarter of subject's vehicle; right lane obstructed.



(a) No avoidance response.

(b) Best chance: Accelerate and steer left.

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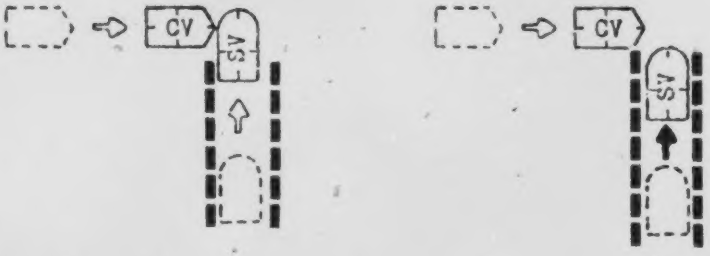
2

② MODULE TITLE:
Collision Avoidance; Avoid being struck by intersecting vehicle

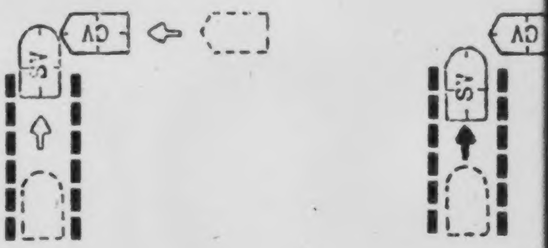
Figure 2.13: Intersecting vehicle threat to left front quarter of subject's vehicle; left and right lanes obstructed.



(a) No avoidance response.

(b) Best chance: Brake straight ahead.

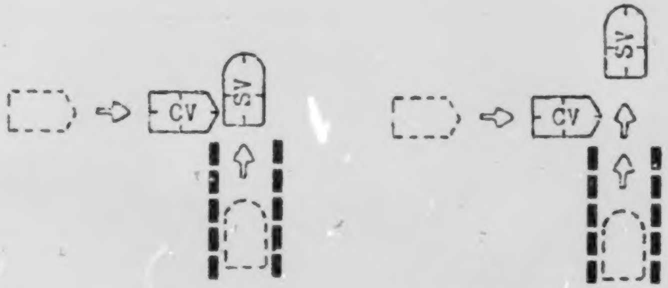
Figure 2.14: Intersecting vehicle threat t
quarter of subject's vehicle;
lanes obstructed.



(a) No avoidance response.

(b) Best chan
straight

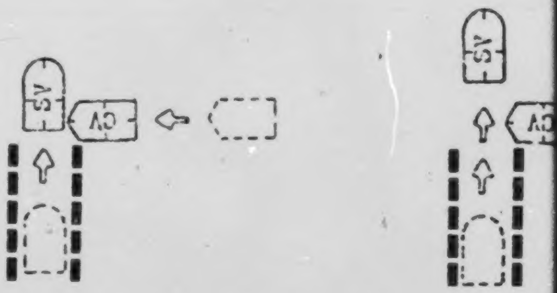
Figure 2.15: Interesecting vehicle threat to left rear quarter of subject's vehicle; left and right lanes obstructed.



(a) No avoidance response.

(b) Best chance: Accelerate straight ahead.

Figure 2.16: Intersecting vehicle threat t
quarter of subject's vehicle;
lanes obstructed.



(a) No avoidance response.

(b) Best chanc
straight a

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Approved By:

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ision Avoidance; Avoid being struck by intersecting vehicle

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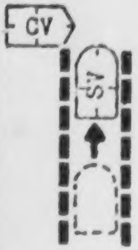

ance: Brake
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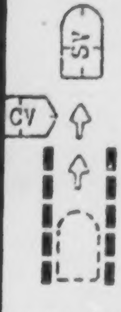
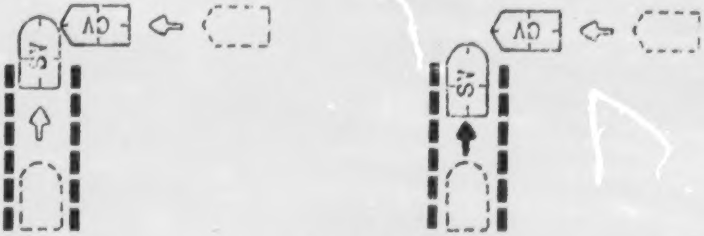
t to left rear
e; left and right



ance: Accelerate
t ahead.

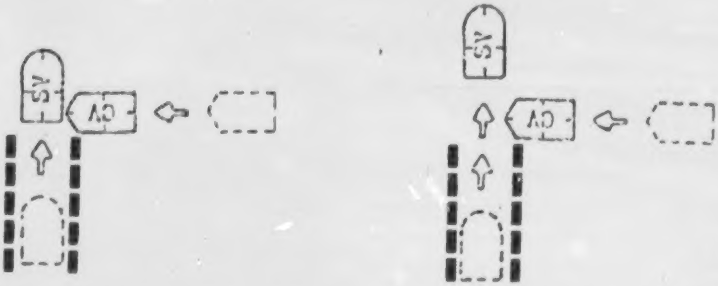
Figure 2.14: Intersecting vehicle threat to right front quarter of subject's vehicle; left and right lanes obstructed.



(a) No avoidance response.

(b) Best chance: Brake straight ahead.

Figure 2.16: Intersecting vehicle threat to right rear quarter of subject's vehicle; left and right lanes obstructed.

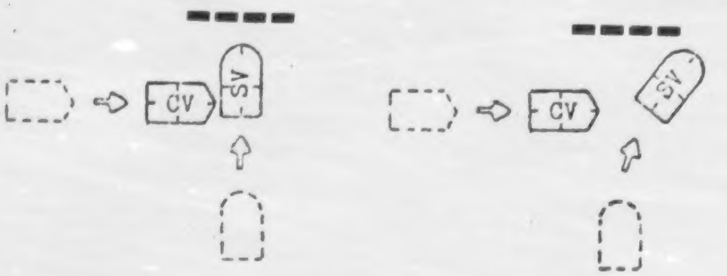


(a) No avoidance response.

(b) Best chance: Accelerate straight ahead.

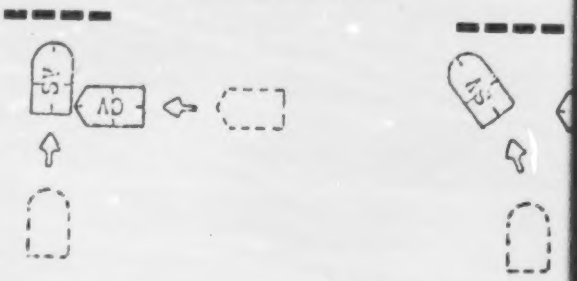
① MODULE NO:	② MODULE TITLE:
2	Collision Avoidance; Avoid being struck by intersecting vehicle

Figure 2.17: Intersecting vehicle threat to left rear quarter of subject's vehicle; lane straight ahead obstructed.



(a) No avoidance response. (b) Best chance: Steer right.

Figure 2.18: Intersecting vehicle threat to quarter of subject's vehicle: ahead obstructed.



(a) No avoidance response. (b) Best chan

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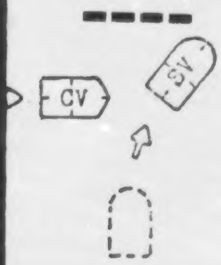
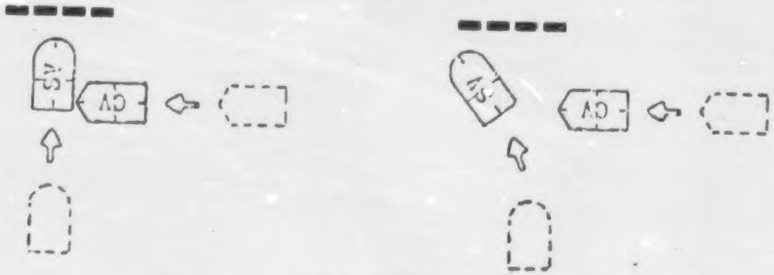
Collision Avoidance; Avoid being struck by intersecting vehicle

eat to left rear
icle; lane straight



chance: Steer right.

Figure 2.18: Intersecting vehicle threat to right rear quarter of subject's vehicle; lane straight ahead obstructed.



(a) No avoidance response.

(b) Best chance: Steer left.

Table 2-1: TRAINING AND TESTING MATERIALS, EQUIPMENT, FACILITIES AND STAFF for MODULE # 2, Collision Avoidance, Intersecting Vehicle Threat

REQUIREMENT			USE	SUBMODULE																		NOTE
CODE		TITLE		A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	
0001	M	Course Summary	* \#	X X																		
0002	M	Module Summary, Module # 2	* \#	O O	X X							X X										
0003	M	Course Schedule	* \#	O O																		
0004	M	Student Schedule Card	*	O	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
0005	M	Student Master Schedule	#	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	
0006	M	Range Layout Diagrams	* \#									O O	O X	X X		O X	X X		O O	X X		
0008	M	BMS Instructions	* \#		O X	X			X													
0009	M	Range Instructions/ Safety	* \#									O O	X X	X X		X X	X X		X X	X X		
0010	M	Equipment/Materials Checklist	#	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	
0012	M	Risk/Waiver Forms	#	O	X	X	X	X	X	X	X	O	X	X	X	X	X	X	X	X	X	
0013	M	Parental Consent Forms	#	O	X	X	X	X	X	X	X	O	X	X	X	X	X	X	X	X	X	4
0014	M	Instruction Procedure, Submodule	#	O	O	O	X	X	O	X	X	O	X	X	X	X	X	X	O	X	X	
0015	M	Content Material, Submodule	#	O	O	O	X	O	O	X	O	O	O	X	O	O	X	O	O	X	O	
0019	E	Movie Projector, 8mm	#	O																		3
0020	P	Instructor, Classroom(I)	@	O	O	O	O	O	O	O	O											
0021	P	Instructor, Classroom(II)	@	O	O	O	O		O	O												
0022	E	Bimodal Simulator (BMS)	@		O	O	O		O	O												
0023	M	Maneuvers List, Submodule	* \#	O O	O O	O O			O O			X X	X X			X X			O O			

See page B-12 of specification for explanation of symbols.

Table 2-1: TRAINING AND TESTING MATERIALS, EQUIPMENT, FACILITIES AND STAFF for MODULE #2 , Collision Avoidance, Intersecting Vehicle Threat

REQUIREMENT			USE	SUBMODULE																		NOTE
CODE		TITLE		A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	
0024	M	Maneuvers Description/ Illustration	* #	O O	O X	O X	X	X	O X	X	X	O X	O X	X	X	O X	X	X	O O	X	X	
0025	M	Maneuvers Procedures	* #	O O	O O	O O			O O			O O	O O	 X		O O	 X		O O	 X		
0027	E	Screen, projection	#	O																		
0030	L	Projector, Movie, 16mm	@	O																		3
0032	M	Attendance Record	#	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	
0033	M	Student Performance Checklist	+ #			O	O	 O	O	O	 O		O	O	 O	O	O	 O		O	 O	
0034	M	Video Tapes (Records)	#					O			O				O			O			O	
0035	P	Range Operations Coordinator	@									O	O	O		O	O			O		
0036	P	Instructor, Range (I)	@									O	O	O	O	O	O	O	O	O	O	
0037	P	Instructor, Range (II)	@									O	O	O		O	O			O		1
0038	F	Range, Auto Driving	@									O	O	O		O	O			O		
0039	E	Auto, Driver Training	@									O	O	O		O	O			O		1
0040	F	Classroom (I)	@	O																		2
0041	F	Classroom (II)	@		O	O	O	O	O	O	O				O			O	O		O	2
0042	E	Range marker cones	@									O	O	O		O	O			O		
0043	E	Range signal flags	@									O	O	O		O	O			O		
0044	M	Range marker stripes	@									O	O	O		O	O			O		
0045	E	Walkie-Talkies	@									O	O	O		O	O			O		
0046	E	Loudspeaker	@									O	O	O		O	O			O		
0047	E	First Aid Kit	@									X	X	X	X	X	X	X	X	X	X	
0048	E	Video Camera	+ @			O	O		O	O		 O	O	O O		O	O O			O O		

Table 2-1: TRAINING AND TESTING MATERIALS, EQUIPMENT, FACILITIES AND STAFF for MODULE #2 , Collision Avoidance, Intersecting Vehicle Threat

REQUIREMENT			USE	SUBMODULE																		NOTE
CODE		TITLE		A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	
0049	E	Video Recorder/Player	+			O	O		O	O			O	O		O	O			O		
			@					O			O			O			O			O		
0050	E	Video Monitor (I)	+			O	O	X	O	O	X		O	O	X	O	O	X		O	X	
0051	E	Video Monitor II	@		O	O	O	O	O	O	O											
0052	E	Crash Helmets	*									O	O	O		O	O			O		
			#									O	O	O		O	O			O		
0053	M	Range Operations Checklist	@									O	O	O		O	O			O		
0054	P	Range Crew	@									O	O	O		O	O			O		
0055	E	Range Support Vehicle	@									O	O	O		O	O			O		
0056	M	Maneuver Sequence List	*	O																		
			#	O			O			O				O			O			O		
0061	M	Simulator Film	#		O	O	O		O	O												
0062	M	Conflict Situation Movie	#	O																		
0063	M	Conflict Presentation Schedule	#				O			O		X	O	O		O	O			O		
0064	M	Conflict Situation Diagrams	*	O	X	X		X	X		X	X			X			X			X	
			#	O	X	X	X	X	X	X	X	X			X			X			X	
0065	E	Surrogate Vehicle	@									O	O	O		O	O			O		1
0066	E	Controller, Surrogate Vehicle	@									O										
			#										O	O		O	O			O		1
0067	E	Emergency Equipment	@									X	X	X		X	X			X		

NOTES: (1) Two are required.

(2) Choice of classroom based on recommended class size.

(3) Choice of projector depends on type of movie film used.

(4) If appropriate.

SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO:	② MODULE TITLE:
2	Collision Avoidance; Avoid being struck by intersecting vehicle.

Table 2-2: Obstruction variables and best-chance avoidance maneuvers for intersecting vehicle threat c

CONFLICT VARIABLES	KEY	MANEUVER ALTERNATIVES BY OBSTRUCTION VARIABLES			
		NO OBSTRUCTIONS	LEFT LANE OBSTRUCTED	RIGHT LANE OBSTRUCTED	LEFT AND RIGHT LANES OBSTRUCTED
Intersecting vehicle approaching from left; will strike left front quarter of subject's vehicle (Condition #1a)	BEST CHANCE MANEUVER	Brake and steer left	Brake and steer right	Brake and steer left	Brake straigh ahead
	RESULTANT	Avoidance	Severity reduction	Avoidance	Severity reduction
	ILLUSTRATION	FIG. 2.1	FIG. 2.5	FIG. 2.9	FIG. 2.13
Intersecting vehicle approaching from right; will strike right front quarter of subject's vehicle (Condition #1b).	BEST CHANCE MANEUVER	Brake and steer right	Brake and steer right	Brake and steer left	Brake staight ahead
	RESULTANT	Avoidance	Avoidance	Severity reduction	Severity reduction
	ILLUSTRATION	FIG. 2.2	FIG. 2.6	FIG. 2.10	FIG. 2.14
Intersecting vehicle approaching from left; will strike left rear quarter of subject's vehicle (Condition #2a)	BEST CHANCE MANEUVER	Accelerate and steer right	Accelerate and steer right	Accelerate straight ahead	Accelerate straight ahea
	RESULTANT	Avoidance	Avoidance	Avoidance(2)	Avoidance(2)
	ILLUSTRATION	FIG. 2.3	FIG. 2.7	FIG. 2.11	FIG. 2.15
Intersecting vehicle approaching from right; will strike right rear quarter of subject's vehicle (Condition #2b)	BEST CHANCE MANEUVER	Accelerate and steer left	Accelerate straight ahead	Accelerate and steer left	Accelerate straight ahead
	RESULTANT	Avoidance	Avoidance(2)	Avoidance	Avoidance(2)
	ILLUSTRATION	FIG. 2.4	FIG. 2.8	FIG. 2.12	FIG. 2.16

NOTES: (1) Not applicable, since straight ahead maneuver is never recommended for this conflict condition
(2) Less likely to achieve complete collision avoidance, but preferable to any turning maneuver.

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R ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

ision Avoidance; Avoid being struck by intersecting vehicle.

est-chance avoidance maneuvers for intersecting vehicle threat conflicts.

MANEUVER ALTERNATIVES BY OBSTRUCTION VARIABLES				
NO OBSTRUCTIONS	LEFT LANE OBSTRUCTED	RIGHT LANE OBSTRUCTED	LEFT AND RIGHT LANES OBSTRUCTED	STRAIGHT AHEAD OBSTRUCTED
Brake and steer left	Brake and steer right	Brake and steer left	Brake straight ahead	N/A(1)
Avoidance	Severity reduction	Avoidance	Severity reduction	
FIG. 2.1	FIG. 2.5	FIG. 2.9	FIG. 2.13	FIG.
Brake and steer right	Brake and steer right	Brake and steer left	Brake staight ahead	N/A(1)
Avoidance	Avoidance	Severity reduction	Severity reduction	
FIG. 2.2	FIG. 2.6	FIG. 2.10	FIG. 2.14	FIG.
Accelerate and steer right	Accelerate and steer right	Accelerate straight ahead	Accelerate straight ahead	Steer right
Avoidance	Avoidance	Avoidance(2)	Avoidance(2)	Severity reduction
FIG. 2.3	FIG. 2.7	FIG. 2.11	FIG. 2.15	FIG. 2.17
Accelerate and steer left	Accelerate straight ahead	Accelerate and steer left	Accelerate straight ahead	Steer left
Avoidance	Avoidance(2)	Avoidance	Avoidance(2)	Severity reduction
FIG. 2.4	FIG. 2.8	FIG. 2.12	FIG. 2.16	FIG. 2.18

ahead maneuver is never recommended for this conflict condition.
e collision avoidance, but preferable to any turning maneuver.

ared G. R. Hatterick	Approved By:	Page 2-28

MODULE NO: 3

COLLISION AVOIDANCE

AVOID STRIKING AN INTERSECTING VEHICLE

(Intersecting Vehicle Obstacle)

SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

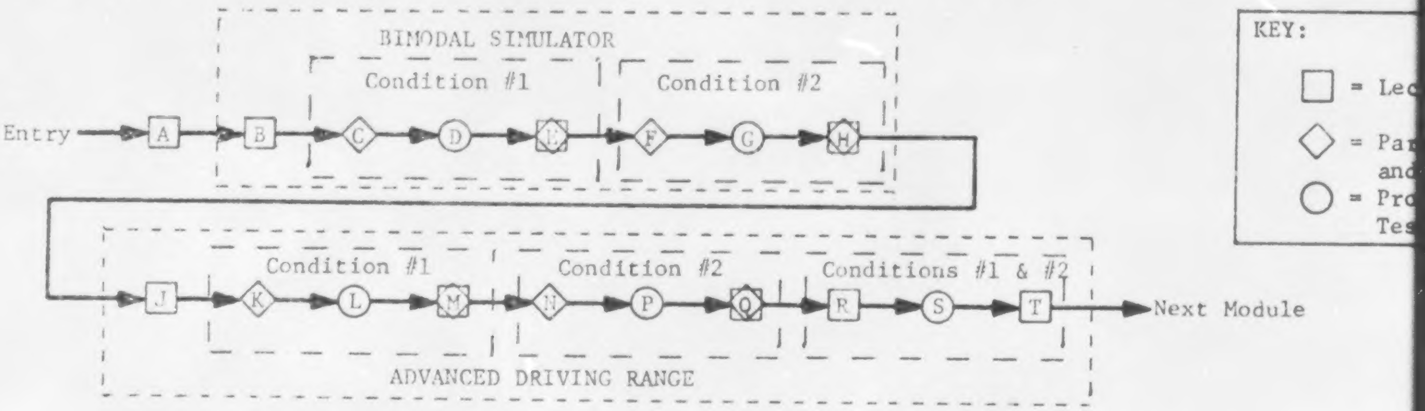
(1) MODULE NO: 3	(2) MODULE TITLE: Collision Avoidance; Avoid striking an intersecting vehicle.

(3) PURPOSE OF MODULE: To provide students with the perceptual skills to recognize this type of conflict, maneuvering skills to successfully avoid, or reduce the effects of, a collision.

(4) STUDENT ENTRANCE PREREQUISITES: Completion of Module #1; A valid automobile operator's license.

(5) APPLICABLE INSTRUCTION TECHNIQUES: Classroom lecture; Bimodal simulator; Advanced driving range.

(6) INSTRUCTIONAL APPROACH: Instruction will be given in a series of submodules:



A: Lecture- Intersecting vehicle obstacle
B: Bimodal Simulator Demonstration
C: Simulator Practice, Condition #1
D: Simulator Test, Condition #1
E: Simulator Test Debriefing, Condition #1
F: Simulator Practice, Condition #2
G: Simulator Test, Condition #2
H: Simulator Test Debriefing, Condition #2
J: Advanced Driving Range Demonstration
K: Advanced Range Practice, Condition #1
L: Advanced Range Test, Condition #1
M: Advanced Range Test Debriefing, Condition #1
N: Advanced Range Practice, Condition #2
P: Advanced Range Test, Condition #2
Q: Advanced Range Test Debriefing, Condition #2
R: Pre-test Briefing, Advanced Range, Integrated Co
S: Advanced Range Test, Integrated Conditions #1 an
T: Advanced Range Test Debriefing, Integrated Cond

CONDITIONS:

#1 - Subject's vehicle will strike front half of in vehicle, on left or right side, if not success

#2 - Subject's vehicle will strike rear half of int vehicle, on left or right side, if not success

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PF-0530-1/1

TION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

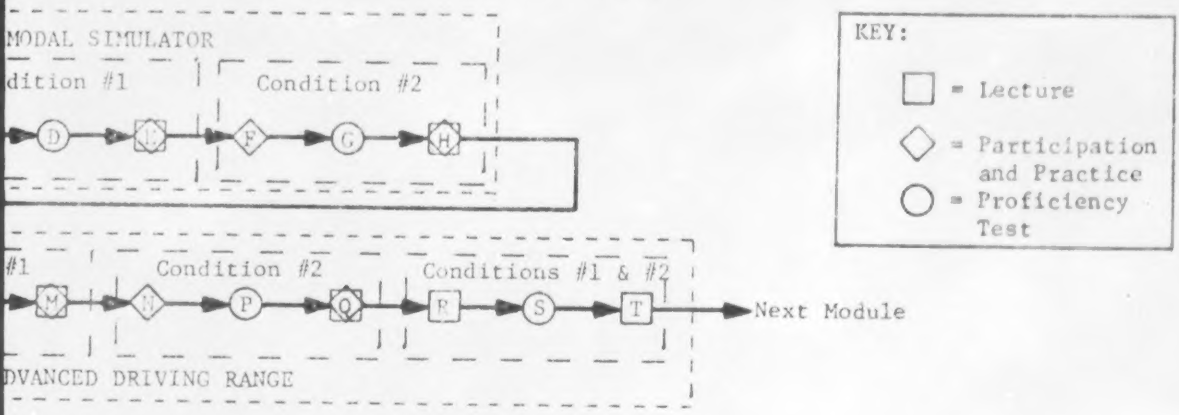
LE: Collision Avoidance; Avoid striking an intersecting vehicle.

de students with the perceptual skills to recognize this type of conflict, and the
ing skills to successfully avoid, or reduce the effects of, a collision.

ES: Completion of Module #1; A valid automobile operator's license.

IQUES: Classroom lecture; Bimodal simulator; Advanced driving range.

ruction will be given in a series of submodules:


MODAL SIMULATOR
dition #1
Condition #2
D
E
F
G
H
#1
Condition #2
Conditions #1 & #2
M
N
P
Q
R
S
T
Next Module
DVANCED DRIVING RANGE
KEY:
= Lecture
= Participation and Practice
= Proficiency Test

le obstacle
tion
on #1
1
Condition #1
on #2
2
Condition #2
nstration
ndition #1
ion #1

M: Advanced Range Test Debriefing, Condition #1
N: Advanced Range Practice, Condition #2
P: Advanced Range Test, Condition #2
Q: Advanced Range Test Debriefing, Condition #2
R: Pre-test Briefing, Advanced Range, Integrated Conditions
S: Advanced Range Test, Integrated Conditions #1 and #2.
T: Advanced Range Test Debriefing, Integrated Conditions #1 & 2

CONDITIONS:

#1 - Subject's vehicle will strike front half of intersecting vehicle, on left or right side, if not successfully avoided.

#2 - Subject's vehicle will strike rear half of intersecting vehicle, on left or right side, if not successfully avoided.

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SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 3

② MODULE TITLE: Collision Avoidance; Avoid striking an intersecting vehicle.

⑦ SUBMODULE NO: 3.A

⑧ SUBMODULE TITLE: Lecture - Intersecting vehicle obstacle.

⑨ SUBMODULE OBJECTIVES:

(1) To develop in the student a cognizance of the characteristics of the onset conditions and potentially successful response maneuvers for the following conflict situations:

  (a) Intersecting vehicle approaching from left side; subject's car will strike at right front quarter. (figure 3.1);
  (b) Intersecting vehicle approaching from right side; subject's car will strike at left front quarter. (figure 3.2);
  (c) Intersecting vehicle approaching from left side; subject's car will strike at right rear quarter. (figure 3.3);
  (d) Intersecting vehicle approaching from right side; subject's car will strike at left rear quarter. (figure 3.4).

(2) To develop in the student a visual image of the characteristics of the onset conditions, multi-vehicle dynamics, and response maneuvers for the above conflict situations.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the four conflict situati the following obstruction variabl

  (a) No obstructions;
  (b) Left lane obstructed;
  (c) Right lane obstructed;
  (d) Left lane and right lane obst

*Obstruction variables are illustrated i through 3.16.

⑪ STUDENT MATERIALS: See Table 3-1

⑫ INSTRUCTOR MATERIALS: See Table 3-1

⑬ EVALUATION MATERIALS: See Table 3-1

⑭ SUPPO See

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Prepared By: G. R. Hatterick

Approved By:

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ATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

E:
Collision Avoidance; Avoid striking an intersecting vehicle.

ITLE: Lecture - Intersecting vehicle obstacle.

a cognizance of the
et conditions and potentially
ers for the following

pproaching from left side;
ike at right front quarter.

pproaching from right side;
ike at left front quarter.

pproaching from left side;
ike at right rear quarter.

pproaching from right side;
ike at left rear quarter.

a visual image of the
et conditions, multi-
onse maneuvers for the

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the four conflict situations will include the following obstruction variables:*

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left lane and right lane obstructed.

*Obstruction variables are illustrated in figures 3.1 through 3.16.

INSTRUCTOR MATERIALS:

See Table 3-1

⑬ EVALUATION MATERIALS:

See Table 3-1

⑭ SUPPORT REQUIREMENTS:

See Table 3-1

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① MODULE NO: 3	② MODULE TITLE: Collision Avoidance; Avoid striking an intersecting vehicle.
⑦ SUBMODULE NO: 3.B	⑧ SUBMODULE TITLE: Bimodal Simulator Demonstration; Intersecting vehicle obstacle.

⑨ SUBMODULE OBJECTIVES:

(1) To familiarize the student with the characteristics of the onset conditions and potentially successful response maneuvers, as they will appear in simulation for the following conflict situations:

- (a) Intersecting vehicle approaching from left side; subject's car will strike at right front quarter. (figure 3.1)
- (b) Intersecting vehicle approaching from right side; subject's car will strike at left front quarter. (figure 3.2);
- (c) Intersecting vehicle approaching from left side; subject's car will strike at right rear quarter. (figure 3.3);
- (d) Intersecting vehicle approaching from right side; subject's car will strike at left rear quarter. (figure 3.4).

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the four conflict situatio
the following obstruction variable

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lane obstructed;
- (d) Left lane and right lane obstr

*Obstruction variables are illustrated in
through 3.16.

⑪ STUDENT MATERIALS: See Table 3-1	⑫ INSTRUCTOR MATERIALS: See Table 3-1	⑬ EVALUATION MATERIALS: See Table 3-1	⑭ SUPPO See

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ION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

Collision Avoidance; Avoid striking an intersecting vehicle.

TLE:
Bimodal Simulator Demonstration; Intersecting vehicle obstacle.

ith the characteristics
potentially successful
will appear in simulation
ituations:

proaching from left side;
ke at right front quarter.

proaching from right side;
ke at left front quarter.

proaching from left side;
ke at right rear quarter.

proaching from right side;
ke at left rear quarter.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the four conflict situations will include the following obstruction variables:*

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lane obstructed;
- (d) Left lane and right lane obstructed.

*Obstruction variables are illustrated in figures 3.1 through 3.16.

INSTRUCTOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPORT REQUIREMENTS:
See Table 3-1	See Table 3-1	See Table 3-1

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① MODULE NO: 3

② MODULE TITLE: Collision Avoidance; Avoid striking an intersecting vehicle.

⑦ SUBMODULE NO: 3.C

⑧ SUBMODULE TITLE: Bimodal Simulator Practice; Intersecting vehicle will be struck a
(Condition #1).

⑨ SUBMODULE OBJECTIVES:

(1) Train student drivers to recognize the onset of these conflict situations at the earliest possible moment;

- (a) Intersecting vehicle approaching from left side; subject's car will strike right front quarter. (figure 3.1);
- (b) Intersecting vehicle approaching from right side; subject's car will strike left front quarter. (figure 3.2).

(2) Train student drivers to instantaneously select, from the available choices, the alternative which will most likely avoid, or minimize the effects of, a collision (See Table 3-2).

(3) Train student drivers to effectively implement the alternative selected through evasive maneuvering of their vehicle.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations wil
the following obstruction variables

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lane obstructed;
- (d) Left lane and right lane obstru

*Obstruction variables are illustrated in f
through 3.16

⑪ STUDENT MATERIALS:	⑫ INSTRUCTOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPORT
See Table 3-1	See Table 3-1	See Table 3-1	See Ta

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N FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

ollision Avoidance; Avoid striking an intersecting vehicle.

Bimodal Simulator Practice: Intersecting vehicle will be struck at front half (Condition #1).

ze the onset of these
est possible moment;

hing from left side;
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hing from right side;
eft front quarter.

aneously select,
alternative which
ize the effects of,

vely implement the
sive maneuvering

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will include the following obstruction variables: *

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lane obstructed;
- (d) Left lane and right lane obstructed.

*Obstruction variables are illustrated in figures 3.1 through 3.16

TRUCTOR MATERIALS: e Table 3-1	⑬ EVALUATION MATERIALS: See Table 3-1	⑭ SUPPORT REQUIREMENTS: See Table 3-1

repared y: G. R. Hatterick	Approved By.	Page 3-4

SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 3

② MODULE TITLE: Collision Avoidance; Avoid striking an intersecting vehicle.

⑦ SUBMODULE NO: 3.D

⑧ SUBMODULE TITLE: Bimodal Simulator Test; Intersecting vehicle will be struck at f car (Condition #1)

⑨ SUBMODULE OBJECTIVES:

(1) To ascertain that each student has learned to recognize the precursor conditions of these conflict situations as soon as they appear:

- (a) Intersecting vehicle approaching from left side; subject's car will strike right front quarter. (figure 3.1);
- (b) Intersecting vehicle approaching from right side; subject's car will strike left front quarter. (figure 3.2).

(2) To determine that the student has learned to select the most feasible alternative available to either avoid, or reduce the effects of, a collision resulting from this conflict.

(3) To determine that the student has learned to effectively implement the avoidance maneuver selected in this conflict situation.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations wil the following obstruction variables

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lane obstructed;
- (d) Left lane and right lane obstru

*Obstruction variables are illustrated in through 3.16

⑪ STUDENT MATERIALS: See Table 3-1

⑫ INSTRUCTOR MATERIALS: See Table 3-1

⑬ EVALUATION MATERIALS: See Table 3-1

⑭ SUPPORT See T

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Approved By:

PF-0530-1/2 (a)

FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

ollision Avoidance; Avoid striking an intersecting vehicle.

Bimodal Simulator Test; Intersecting vehicle will be struck at front half of car (Condition #1)

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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will ~~include~~ the following obstruction variables: *

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lane obstructed;
- (d) Left lane and right lane obstructed.

*Obstruction variables are illustrated in figures 3.1 through 3.16

STRUCTOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPORT REQUIREMENTS:
ee Table 3-1	See Table 3-1	See Table 3-1

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SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 3	② MODULE TITLE: Collision Avoidance; Avoid striking an intersecting vehicle.
⑦ SUBMODULE NO: 3.E	⑧ SUBMODULE TITLE: Bimodal Simulator Test Debriefing; Intersecting vehicle will be half. (Condition #1).

⑨ SUBMODULE OBJECTIVES:

(1) To provide to the student an immediate assessment of the level of performance achieved during the test for the following conflict situations;

  (a) Intersecting vehicle approaching from left side; subject's car will strike right front quarter. (figure 3.1);

  (b) Intersecting vehicle approaching from right side; subject's car will strike left front quarter. (figure 3.2).

(2) To provide to the student specific comments regarding deficiencies in performance and the corrective action required, and instances of superior performance.

(3) To gain from the student an immediate appraisal of difficulties encountered and reactions to the test.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations wil
the following obstruction variable

  (a) No obstructions;
  (b) Left lane obstructed;
  (c) Right lane obstructed;
  (d) Left lane and right lane obstr

*Obstruction variables are illustrated i
through 3.16

⑪ STUDENT MATERIALS:	⑫ INSTRUCTOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPO
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N FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

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Bimodal Simulator Test Debriefing; Intersecting vehicle will be struck at front half. (Condition #1).

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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will include the following obstruction variables: *

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lane obstructed;
- (d) Left lane and right lane obstructed.

*Obstruction variables are illustrated in figures 3.1 through 3.16

TRUCTOR MATERIALS: e Table 3-1	⑬ EVALUATION MATERIALS: See Table 3-1	⑭ SUPPORT REQUIREMENTS: See Table 3-1

repared y: G. R. Hatterick	Approved By:	Page 3-6

SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO:
3

② MODULE TITLE:
Collision Avoidance; Avoid striking an intersecting vehicle.

⑦ SUBMODULE NO:
3.F

⑧ SUBMODULE TITLE: Bimodal Simulator Practice; Intersecting vehicle will be struck
(Condition #2).

⑨ SUBMODULE OBJECTIVES:

(1) Train student drivers to recognize the onset of these conflict situations at the earliest possible moment;
  (a) Intersecting vehicle approaching from left side: will be struck at right rear quarter. (figure 3.3);
  (b) Intersecting vehicle approaching from right side; will be struck at left rear quarter. (figure 3.4).

(2) Train student drivers to instantaneously select, from the available choices, the alternative which will most likely avoid, or minimize the effects of, a collision; (See table 3-2)

(3) Train student drivers to effectively implement the alternative selected through evasive maneuvering of their vehicle.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will
the following obstruction variables
  (a) No obstructions;
  (b) Left lane obstructed;
  (c) Right lane obstructed;
  (d) Left lane and right lane obstru

*Obstruction variables are illustrated in
through 3.16

⑪ STUDENT MATERIALS:
See Table 3-1

⑫ INSTRUCTOR MATERIALS:
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⑬ EVALUATION MATERIALS:
See Table 3-1

⑭ SUPPORT
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OR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

lision Avoidance; Avoid striking an intersecting vehicle.

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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will include the following obstruction variables: *

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left lane and right lane obstructed.

*Obstruction variables are illustrated in figures 3.1 through 3.16

UCTOR MATERIALS: Table 3-1	⑬ EVALUATION MATERIALS: See Table 3-1	⑭ SUPPORT REQUIREMENTS: See Table 3-1

pared G. R. Hatterick	Approved By:	Page 3-7

SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 3	② MODULE TITLE: Collision Avoidance; Avoid striking an intersecting vehicle.
⑦ SUBMODULE NO: 3.G	⑧ SUBMODULE TITLE: Bimodal Simulator Test, Intersecting vehicle will be struck at rea (Condition #2).

⑨ SUBMODULE OBJECTIVES:

(1) To ascertain that each student has learned to recognize the precursor conditions of these conflict situations as soon as they appear;

- (a) Intersecting vehicle approaching from left side; will be struck at rightrear quarter. (figure 3.3);
- (b) Intersecting vehicle approaching from right side; will be struck at left rear quarter. (figure 3.4).

(2) To determine that the student has learned to select the most feasible alternative available to either avoid, or reduce the effects of, a collision resulting from this conflict.

(3) To determine that the student has learned to effectively implement the avoidance maneuver selected in this conflict situation.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will i
the following obstruction variables:

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lane obstructed;
- (d) Left lane and right lane obstructe

*Obstruction variables are illustrated in fi
through 3.16

⑪ STUDENT MATERIALS:	⑫ INSTRUCTOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPORT R
See Table 3-1	See Table 3-1	See Table 3-1	See Tabl

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N FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

Collision Avoidance; Avoid striking an intersecting vehicle.

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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will include the following obstruction variables: *

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left lane and right lane obstructed.

*Obstruction variables are illustrated in figures 3.1 through 3.16

TRUCTOR MATERIALS: e Table 3-1	⑬ EVALUATION MATERIALS: See Table 3-1	⑭ SUPPORT REQUIREMENTS: See Table 3-1

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SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO:
3

② MODULE TITLE:
Collision Avoidance; Avoid striking an intersecting vehicle.

⑦ SUBMODULE NO:
3.H

⑧ SUBMODULE TITLE: Bimodal Simulator Test Debriefing; Intersecting vehicle will be st
rear half (Condition #2).

⑨ SUBMODULE OBJECTIVES:

(1) To provide to the student an immediate assessment of the level of performance achieved during the test for the following conflict situations:

- (a) Intersecting vehicle approaching from left side; will be struck at right rear quarter. (figure 3.3);
- (b) Intersecting vehicle approaching from right side; will be struck at left rear quarter. (figure 3.4).

(2) To provide to the student specific comments regarding deficiencies in performance and the corrective action required, and instances of superior performance.

(3) To gain from the student an immediate appraisal of difficulties encountered and reactions to the test.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will
the following obstruction variables:

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lane obstructed;
- (d) Left lane and right lane obstruc

*Obstruction variables are illustrated in f
through 3.16

⑪ STUDENT MATERIALS:
See Table 3-1

⑫ INSTRUCTOR MATERIALS:
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⑬ EVALUATION MATERIALS:
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⑭ SUPPORT
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FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

ollision Avoidance; Avoid striking an intersecting vehicle.

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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will include the following obstruction variables: *

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left lane and right lane obstructed.

*Obstruction variables are illustrated in figures 3.1 through 3.16

STRUCTOR MATERIALS: e Table 3-1	⑬ EVALUATION MATERIALS: See Table 3-1	⑭ SUPPORT REQUIREMENTS: See Table 3-1

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SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 3

② MODULE TITLE: Collision Avoidance; Avoid striking an intersecting vehicle.

⑦ SUBMODULE NO: 3.J

⑧ SUBMODULE TITLE: Advanced Driving Range Demonstration; Intersecting vehicle obstacl

⑨ SUBMODULE OBJECTIVES:

(1) To familiarize the student with the characteristics of the onset conditions and potentially successful response maneuvers, as they will appear on the driving range, for the following conflict situations.

- (a) Intersecting vehicle approaching from left side; subject's car will strike at right front quarter. (figure 3.1);
- (b) Intersecting vehicle approaching from right side; subject's car will strike at left front quarter. (figure 3.2);
- (c) Intersecting vehicle approaching from left side; subject's car will strike at right rear quarter. (figure 3.3);
- (d) Intersecting vehicle approaching from right side; subject's car will strike at left rear quarter. (figure 3.4).

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the four conflict situations w the following obstruction variables: *

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lane obstructed;
- (d) Left lane and right lane obstructe

(2) Only student participants and required staff will be permitted on the range d submodule.

(3) All range safety equipment and procedu verified prior to initiating demonstra sessions.

(4) Range Safety Monitor must be on duty a during the use of the range.

*Obstruction variables are illustrated in fig through 3.16.

⑪ STUDENT MATERIALS:	⑫ INSTRUCTOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPORT R
See Table 3-1	See Table 3-1	See Table 3-1	See Tabl

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ON FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

Collision Avoidance; Avoid striking an intersecting vehicle.

E: Advanced Driving Range Demonstration; Intersecting vehicle obstacle.

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at left rear quarter.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the four conflict situations will include the following obstruction variables: *

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lane obstructed;
- (d) Left lane and right lane obstructed.

(2) Only student participants and required instructor staff will be permitted on the range during this submodule.

(3) All range safety equipment and procedures will be verified prior to initiating demonstration sessions.

(4) Range Safety Monitor must be on duty at all times during the use of the range.

*Obstruction variables are illustrated in figures 3.1 through 3.16.

NSTRUCTOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPORT REQUIREMENTS:
See Table 3-1	See Table 3-1	See Table 3-1

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SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 3

② MODULE TITLE: Collision Avoidance; Avoid striking an intersecting vehicle.

⑦ SUBMODULE NO: 3.K

⑧ SUBMODULE TITLE: Advanced Driving Range Practice; Intersecting vehicle will be st front half of car (Condition #1).

⑨ SUBMODULE OBJECTIVES:

(1) Train student drivers to recognize the onset of these conflict situations at the earliest possible moment:
  (a) Intersecting vehicle approaching from left side; subject's car will strike right front quarter. (figure 3.1);
  (b) Intersecting vehicle approaching from right side; subject's car will strike left front quarter. (figure 3.2).

(2) Train student drivers to instantaneously select, from the available choices, the alternative which will most likely avoid, or minimize the effects of, a collision. (See Table 3-2)

(3) Train student drivers to effectively implement the alternative selected through evasive maneuvering of their vehicle.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Only student participants and requir staff will be permitted on the range submodule.

(2) All range safety equipment and proce verified prior to initiating student sessions.

(3) Range Safety Monitor must be on duty during the use of the range.

(4) Each of the conflict situations will following obstruction variables: *
  (a) No obstructions;
  (b) Left lane obstructed;
  (c) Right lane obstructed;
  (d) Left lane and right lane obstruc

*Obstruction variables are illustrated in through 3.16

⑪ STUDENT MATERIALS:	⑫ INSTRUCTOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPORT
See Table 3-1	See Table 3-1	See Table 3-1	See Tabl

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ON FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

Collision Avoidance; Avoid striking an intersecting vehicle.

E: Advanced Driving Range Practice; Intersecting vehicle will be struck at front half of car (Condition #1).

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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Only student participants and required instructor staff will be permitted on the range during this submodule.

(2) All range safety equipment and procedures will be verified prior to initiating student practice sessions.

(3) Range Safety Monitor must be on duty at all times during the use of the range.

(4) Each of the conflict situations will include the following obstruction variables: *

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left lane and right lane obstructed.

*Obstruction variables are illustrated in figures 3.1 through 3.16

INSTRUCTOR MATERIALS:

See Table 3-1

⑬ EVALUATION MATERIALS:

See Table 3-1

⑭ SUPPORT REQUIREMENTS:

See Table 3-1

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SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 3

② MODULE TITLE: Collision Avoidance; Avoid striking an intersecting vehicle.

⑦ SUBMODULE NO: 3.L

⑧ SUBMODULE TITLE: Advanced Driving Range Test: Intersecting vehicle will be struck a
half of car (Condition #1).

⑨ SUBMODULE OBJECTIVES:

(1) To ascertain that each student has learned to recognize the precursor conditions of these conflict situations as soon as they appear:

   (a) Intersecting vehicle approaching from left side; subject's car will strike right front quarter (figure 3.1);
   (b) Intersecting vehicle approaching from right side; subject's car will strike left front quarter.
   (figure 3.2).

(2) To determine that the student has learned to select the most feasible alternative available to either avoid, or reduce the effects of, a collision resulting from this conflict.

(3) To determine that the student has learned to effectively implement the avoidance maneuver selected in this conflict situation.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Only student participants and required
staff will be permitted on the range d
submodule.

(2) All range safety equipment and procedu
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(3) Range Safety Monitor must be on duty a
during the use of the range.

(4) Each of the conflict situations will i
following obstruction variables: *

   (a) No obstructions;
   (b) Left lane obstructed;
   (c) Right lane obstructed;
   (d) Left lane and right lane obstructe

*Obstruction variables are illustrated in fig
through 3.16

⑪ STUDENT MATERIALS: See Table 3-1

⑫ INSTRUCTOR MATERIALS: See Table 3-1

⑬ EVALUATION MATERIALS: See Table 3-1

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N FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

Collision Avoidance; Avoid striking an intersecting vehicle.

: Advanced Driving Range Test: Intersecting vehicle will be struck at front half of car (Condition #1).

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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Only student participants and required instructor staff will be permitted on the range during this submodule.

(2) All range safety equipment and procedures will be verified prior to initiating student practice sessions.

(3) Range Safety Monitor must be on duty at all times during the use of the range.

(4) Each of the conflict situations will include the following obstruction variables: *

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left lane and right lane obstructed.

*Obstruction variables are illustrated in figures 3.1 through 3.16

TRUCTOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPORT REQUIREMENTS:
Table 3-1	See Table 3-1	See Table 3-1

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SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 3

② MODULE TITLE: Collision Avoidance; Avoid striking an intersecting vehicle.

⑦ SUBMODULE NO: 3.M

⑧ SUBMODULE TITLE: Advanced Driving Range Test Debriefing; Intersecting vehicle will front half (Condition #1).

⑨ SUBMODULE OBJECTIVES:

(1) To provide to the student an immediate assessment of the level of performance achieved during the test, for the following conflict situations;

- (a) Intersecting vehicle approaching from left side: subject's car will strike right front quarter. (figure 3.1);
- (b) Intersecting vehicle approaching from right side; subject's car will strike left front quarter. (figure 3.2).

(2) To provide to the student specific comments regarding deficiencies in performance and the corrective action required, and instances of superior performance.

(3) To gain from the student an immediate appraisal of difficulties encountered and reactions to the test.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will in the following obstruction variables: *

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lane obstructed;
- (d) Left lane and right lane obstructe

*Obstruction variables are illustrated in fi through 3.16

⑪ STUDENT MATERIALS: See Table 3-1	⑫ INSTRUCTOR MATERIALS: See Table 3-1	⑬ EVALUATION MATERIALS: See Table 3-1	⑭ SUPPORT R See Tabl

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Advanced Driving Range Test Debriefing; Intersecting vehicle will be struck at front half (Condition #1).

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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will include the following obstruction variables: *

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lane obstructed;
- (d) Left lane and right lane obstructed.

*Obstruction variables are illustrated in figures 3.1 through 3.16

RUCTOR MATERIALS: Table 3-1	⑬ EVALUATION MATERIALS: See Table 3-1	⑭ SUPPORT REQUIREMENTS: See Table 3-1

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① MODULE NO: 3

② MODULE TITLE: Collision Avoidance; Avoid striking an intersecting vehicle.

⑦ SUBMODULE NO: 3.N

⑧ SUBMODULE TITLE: Advanced Driving Range Practice: Intersecting vehicle will be str
half of car (Condition #2).

⑨ SUBMODULE OBJECTIVES:

(1) Train student drivers to recognize the onset of these conflict situations at the earliest possible moment;

- (a) Intersecting vehicle approaching from left side; will be struck at right rear quarter. (figure 3.3);
- (b) Intersecting vehicle approaching from right side; will be struck at left rear quarter (figure 3.4).

(2) Train student drivers to instantaneously select, from the available choices, the alternative which will most likely avoid, or minimize the effects of, a collision. (See Table 3-2)

(3) Train student drivers to effectively implement the alternative selected through evasive maneuvering of their vehicle.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Only student participants and requi
staff will be permitted on the range
submodule.

(2) All range safety equipment and proce
verified prior to initiating student
sessions.

(3) Range Safety Monitor must be on duty
during the use of the range.

(4) Each of the conflict situations will
following obstruction variables: *

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lane obstructed;
- (d) Left lane and right lane obstruc

*Obstruction variables are illustrated in f
through 3.16

⑪ STUDENT MATERIALS:	⑫ INSTRUCTOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPORT
See Table 3-1	See Table 3-1	See Table 3-1	See Table

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LE:
Collision Avoidance; Avoid striking an intersecting vehicle.

TITLE: Advanced Driving Range Practice: Intersecting vehicle will be struck at rear half of car (Condition #2).

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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Only student participants and required instructor staff will be permitted on the range during this submodule.

(2) All range safety equipment and procedures will be verified prior to initiating student practice sessions.

(3) Range Safety Monitor must be on duty at all times during the use of the range.

(4) Each of the conflict situations will include the following obstruction variables: *

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left lane and right lane obstructed.

*Obstruction variables are illustrated in figures 3.1 through 3.16

INSTRUCTOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPORT REQUIREMENTS:
See Table 3-1	See Table 3-1	See Table 3-1

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SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 3	② MODULE TITLE: Collision Avoidance; Avoid striking an intersecting vehicle.
⑦ SUBMODULE NO: 3.P	⑧ SUBMODULE TITLE: Advanced Driving Range Test; Intersecting vehicle will be struck at of car (Condition #2).

⑨ SUBMODULE OBJECTIVES:

(1) To ascertain that each student has learned to recognize the precursor conditions of these conflict situations as soon as they appear;

  (a) Intersecting vehicle approaching from left side; will be struck at right rear quarter. (figure 3.3);

  (b) Intersecting vehicle approaching from right side; will be struck at left rear quarter. (figure 3.4).

(2) To determine that the student has learned to select the most feasible alternative available to either avoid, or reduce the effects of, a collision resulting from this conflict.

(3) To determine that the student has learned to effectively implement the avoidance maneuver selected in this conflict situation.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Only student participants and required
staff will be permitted on the range du
submodule.

(2) All range safety equipment and procedur
verified prior to initiating student pr
sessions.

(3) Range Safety Monitor must be on duty at
during the use of the range.

(4) Each of the conflict situations will in
following obstruction variables:*

  (a) No obstructions;

  (b) Left lane obstructed;

  (c) Right lane obstructed;

  (d) Left lane and right lane obstructed

*Obstruction variables are illustrated in figu
through 3.16

⑪ STUDENT MATERIALS:	⑫ INSTRUCTOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPORT RE
See Table 3-1	See Table 3-1	See Table 3-1	See Table 3-

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ION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

Collision Avoidance; Avoid striking an intersecting vehicle.

LE: Advanced Driving Range Test; Intersecting vehicle will be struck at rear half of car (Condition #2).

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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Only student participants and required instructor staff will be permitted on the range during this submodule.

(2) All range safety equipment and procedures will be verified prior to initiating student practice sessions.

(3) Range Safety Monitor must be on duty at all times during the use of the range.

(4) Each of the conflict situations will include the following obstruction variables:*

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left lane and right lane obstructed.

*Obstruction variables are illustrated in Figures 3.1 through 3.16

NSTRUCTOR MATE ALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPORT REQUIREMENTS:
e Table 3-1	See Table 3-1	See Table 3-1

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① MODULE NO:
3

② MODULE TITLE:
Collision Avoidance; Avoid striking an intersecting vehicle.

⑦ SUBMODULE NO:
3.Q

⑧ SUBMODULE TITLE: Advanced Driving Range Test Debriefing; Intersecting vehicle will
at rear half (Condition #2).

⑨ SUBMODULE OBJECTIVES:

(1) To provide to the student an immediate assessment of the level of performance achieved during the test, for the following conflicts:

  (a) Intersecting vehicle approaching from left side; will be struck at right rear quarter. (figure 3.3);
  (b) Intersecting vehicle approaching from right side; will be struck at left rear quarter. (figure 3.4).

(2) To provide to the student specific comments regarding deficiencies in performance and the corrective action required, and instances of superior performance.

(3) To gain from the student an immediate appraisal of difficulties encountered and reactions to the test.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will
the following obstruction variables:*

  (a) No obstructions;
  (b) Left lane obstructed;
  (c) Right lane obstructed;
  (d) Left lane and right lane obstruc

*Obstruction variables are illustrated in
through 3.16

⑪ STUDENT MATERIALS:	⑫ INSTRUCTOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPORT
See Table 3-1	See Table 3-1	See Table 3-1	See Tab

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N FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

ollision Avoidance; Avoid striking an intersecting vehicle.

Advanced Driving Range Test Debriefing; Intersecting vehicle will be struck
at rear half (Condition #2).

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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will include the following obstruction variables:*

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lane obstructed;
- (d) Left lane and right lane obstructed.

*Obstruction variables are illustrated in figures 3.1 through 3.16

STRUCTOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPORT REQUIREMENTS:
e Table 3-1	See Table 3-1	See Table 3-1

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SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 3

② MODULE TITLE: Collision Avoidance; Avoid striking an intersecting vehicle.

⑦ SUBMODULE NO: 3.R

⑧ SUBMODULE TITLE: Pre-Test Briefing, Advanced Driving Range Test; Intersecting vehicl struck at either the front half (Condition #1) or rear half (Condition #2).

⑨ SUBMODULE OBJECTIVES:

(1) To prepare the student for conduct of the integrated testing submodule by describing the scope of the test, reviewing the characteristics of the included conflict situations, and describing the maneuvers most likely to be successful for the following conflict situations:

  (a) Intersecting vehicle approaching from left side; subject's car will strike at right front quarter. (figure 3.1);
  (b) Intersecting vehicle approaching from right side; subject's car will strike at left front quarter. (figure 3.2);
  (c) Intersecting vehicle approaching from left side; subject's car will strike at right rear quarter. (figure 3.3);
  (d) Intersecting vehicle approaching from right side; subject's car will strike at left rear quarter. (figure 3.4).

(2) To assure that the student comprehends the need to select the most appropriate course of evasive action based on the specific characteristics of the conflict situations confronting him.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the four conflict situations w the following obstruction variables: *

  (a) No obstructions;
  (b) Left lane obstructed;
  (c) Right lane obstructed;
  (d) Left lane and right lane obstructe

*Obstruction variables are illustrated in fi through 3.16

⑪ STUDENT MATERIALS:	⑫ INSTRUCTOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPORT R
See Table 3-1	See Table 3-1	See Table 3-1	See Tabl

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PF-0530-1/2 (a)

FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

llision Avoidance; Avoid striking an intersecting vehicle.

Pre-Test Briefing, Advanced Driving Range Test; Intersecting vehicle may be
er the front half (Condition #1) or rear half (Condition #2).

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⑩ **SPECIAL PRECAUTIONS AND PROCEDURES:**

(1) Each of the four conflict situations will include the following obstruction variables: *

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left lane and right lane obstructed.

*Obstruction variables are illustrated in figures 3.1 through 3.16

RUCTOR MATERIALS:

Table 3-1

⑬ EVALUATION MATERIALS:

See Table 3-1

⑭ SUPPORT REQUIREMENTS:

See Table 3-1

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: G. R. Hatterick

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By:

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SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 3	② MODULE TITLE: Collision Avoidance; Avoid striking an intersecting vehicle.
⑦ SUBMODULE NO: 3.S	⑧ SUBMODULE TITLE: Integrated Advanced Range Test: Intersecting vehicle may be struck the front half (Condition #1) or the rear half (Condition #2).

⑨ SUBMODULE OBJECTIVES:

(1) To ascertain that each student has learned to recognize the precursor conditions of these conflict situations as soon as they appear:

- (a) Intersecting vehicle approaching from left side; subject's car will strike at right front quarter. (figure 3.1);
- (b) Intersecting vehicle approaching from right side; subject's car will strike at left front quarter. (figure 3.2);
- (c) Intersecting vehicle approaching from left side; subject's car will strike at right rear quarter. (figure 3.3);
- (d) Intersecting vehicle approaching from right side; subject's car will strike at left rear quarter. (figure 3.4).

(2) To determine that the student has learned to select the most feasible alternative available to either avoid, or reduce the effects of, a collision resulting from this conflict;

(3) To determine that the student has learned to effectively implement the avoidance maneuver selected in this conflict situation.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Only student participants and required
staff will be permitted on the range d
submodule.

(2) All range safety equipment and procedu
verified prior to initiating student p
sessions.

(3) Range Safety Monitor must be on duty a
during the use of the range.

(4) Each of the conflict situations will f
following obstruction variables: *

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lane obstructed;
- (d) Left lane and right lane obstructe

*Obstruction variables are illustrated in f
through 3.16

⑪ STUDENT MATERIALS: See Table 3-1	⑫ INSTRUCTOR MATERIALS: See Table 3-1	⑬ EVALUATION MATERIALS: See Table 3-1	⑭ SUPPORT R See Table

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PF-0530-1/2 (a)

FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

ollision Avoidance; Avoid striking an intersecting vehicle.

Integrated Advanced Range Test: Intersecting vehicle may be struck at either
he front half (Condition #1)or the rear half (Condition #2).

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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Only student participants and required instructor staff will be permitted on the range during this submodule.

(2) All range safety equipment and procedures will be verified prior to initiating student practice sessions.

(3) Range Safety Monitor must be on duty at all times during the use of the range.

(4) Each of the conflict situations will include the following obstruction variables: *

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left lane and right lane obstructed.

*Obstruction variables are illustrated in figures 3.1 through 3.16

UCTOR MATERIALS: able 3-1	⑬ EVALUATION MATERIALS: See Table 3-1	⑭ SPECIAL REQUIREMENTS: See Table 3-1

pared G. R. Hatterick	Approved By:	Page 3-18

SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 3	② MODULE TITLE: Collision Avoidance; Avoid striking an intersecting vehicle.
⑦ SUBMODULE NO: 3.T	⑧ SUBMODULE TITLE: Integrated Advanced Driving Range Test Debriefing; Intersecting v be struck at either front half (Condition #1) or rear half (Condition #2.

⑨ SUBMODULE OBJECTIVES:

(1) To provide to the student an immediate assessment of the level of performance achieved during the test, for the following conflicts:

- (a) Intersecting vehicle approaching from left side; subject's car will strike at right front quarter. (figure 3.1);
- (b) Intersecting vehicle approaching from right side; subject's car will strike at left front quarter. (figure 3.2)
- (c) Intersecting vehicle approaching from left side; subject's car will strike at right rear quarter. (figure 3.3);
- (d) Intersecting vehicle approaching from right side; subject's car will strike at left rear quarter. (figure 3.4).

(2) To provide to the student specific comments regarding deficiencies in performance and the corrective action required, and instances of superior performance.

(3) To gain from the student an immediate appraisal of difficulties encountered and reactions to the test.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the four conflict situations the following obstruction variables:*

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lane obstructed;
- (d) Left lane and right lane obstruc

*Obstruction variables are illustrated in f through 3.16

⑪ STUDENT MATERIALS: See Table 3-1	⑫ INSTRUCTOR MATERIALS: See Table 3-1	⑬ EVALUATION MATERIALS: See Table 3-1	⑭ SUPPORT See Tab

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PF-0530-1/2 (a)

FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

llision Avoidance; Avoid striking an intersecting vehicle.

Integrated Advanced Driving Range Test Debriefing; Intersecting vehicle will
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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the four conflict situations will include the following obstruction variables:*

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left lane and right lane obstructed.

*Obstruction variables are illustrated in figures 3.1 through 3.16

RUCTOR MATERIALS:

Table 3-1

⑬ EVALUATION MATERIALS:

See Table 3-1

⑭ SUPPORT REQUIREMENTS:

See Table 3-1

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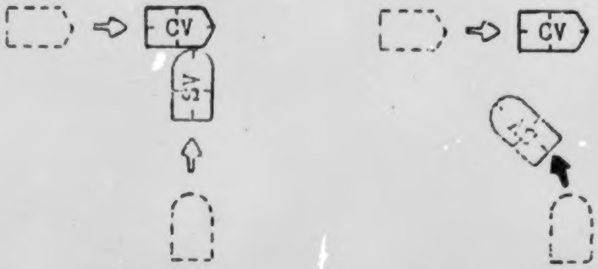
① MODULE NO: 3	② MODULE TITLE: Collision Avoidance; Avoid striking an intersecting vehicle.

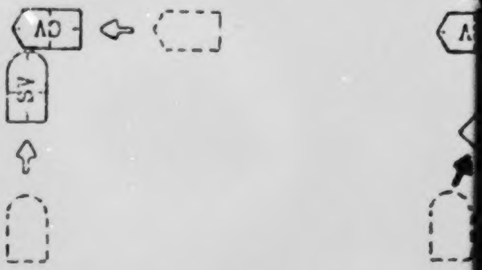
Figure 3.1: Intersecting vehicle obstacle; Will be struck by subject's vehicle at right front quarter; no obstructions.



(a) No avoidance response.

(b) Best chance: Brake and steer left.

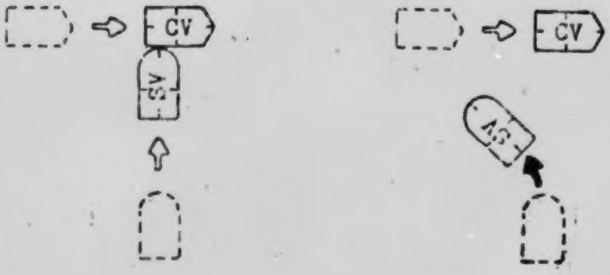
Figure 3.2: Intersecting vehicle obstacle; W by subject's vehicle at left fro no obstructions.



(a) No avoidance response.

(b) Best chan steer rig

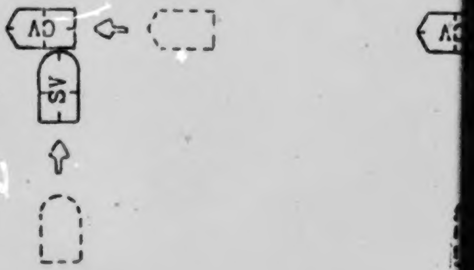
Figure 3.3: Intersecting vehicle obstacle; Will be struck by subject's vehicle at right rear quarter; no obstructions.



(a) No avoidance response.

(b) Best chance: Brake and steer left.

Figure 3.4: Intersecting vehicle obstacle; W by subject's vehicle at left rea no obstructions.



(a) No avoidance response.

(b) Best chan steer rig

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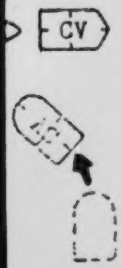
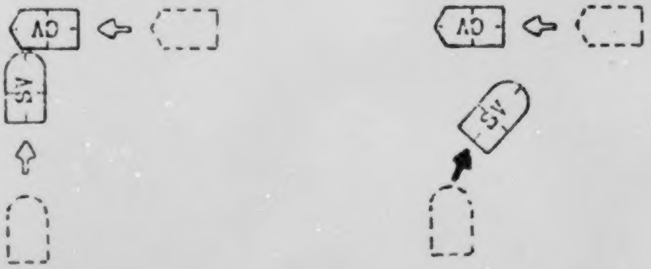


chance: Brake and
r left.

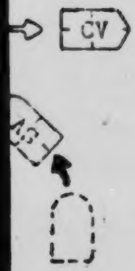
Figure 3.2: Intersecting vehicle obstacle; Will be struck by subject's vehicle at left front quarter; no obstructions.



(a) No avoidance response.

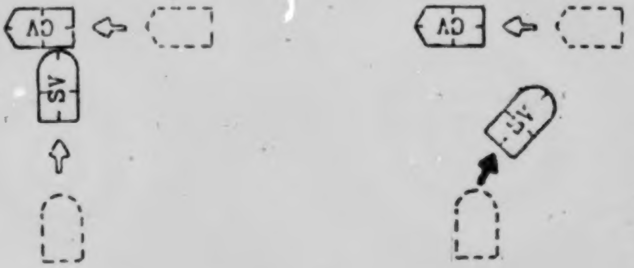
(b) Best chance: Brake and steer right.

e; Will be struck
t rear quarter;



chance: Brake and
left.

Figure 3.4: Intersecting vehicle obstacle; Will be struck by subject's vehicle at left rear quarter; no obstructions.

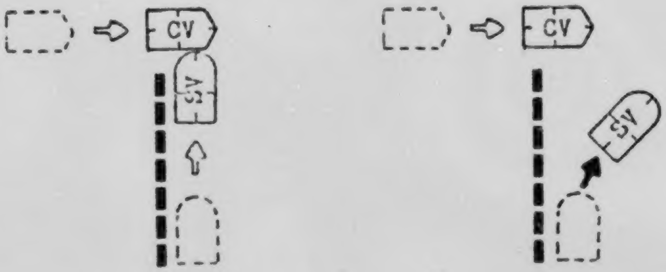


(a) No avoidance response.

(b) Best chance: Brake and steer right.

① MODULE NO: 3	② MODULE TITLE: Collision Avoidance; Avoid striking an intersecting vehicle.

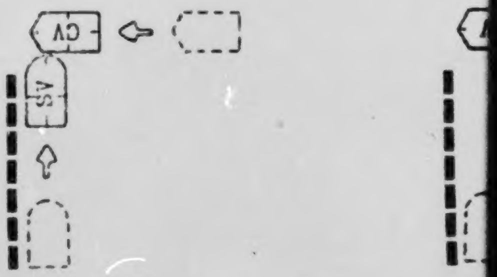
Figure 3.5: Intersecting vehicle obstacle; Will be struck by subject's vehicle at right front quarter; Left lane obstructed.



(a) No avoidance response.

(b) Best chance: Brake and steer right.

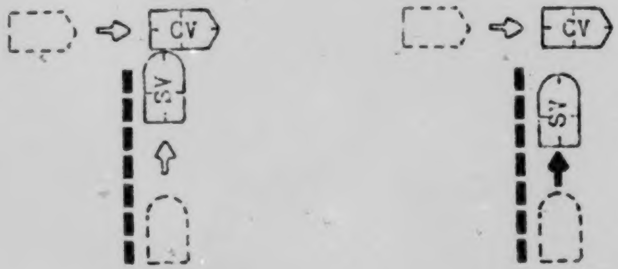
Figure 3.6: Intersecting vehicle obstacle; W
by subject's vehicle at left fr
Left lane obstructed.



(a) No avoidance response.

(b) Best cha
steer ri

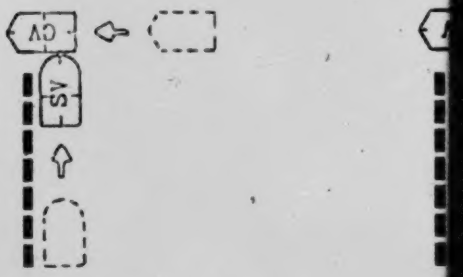
Figure 3.7: Intersecting vehicle obstacle; Will be struck by subject's vehicle at right rear quarter; Left lane obstructed.



(a) No avoidance response.

(b) Best chance: Brake straight ahead.

Figure 3.8: Intersecting vehicle obstacle;
by subject's vehicle at left re
Left lane obstructed.



(a) No avoidance response.

(b) Best ch
steer r

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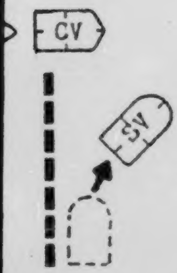
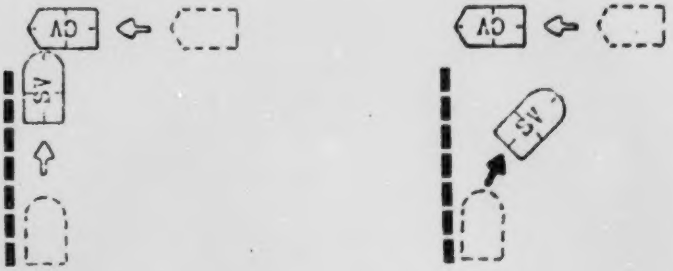


chance: Brake and
r right.

Figure 3.6: Intersecting vehicle obstacle; Will be struck by subject's vehicle at left front quarter; Left lane obstructed.



(a) No avoidance response.

(b) Best chance: Brake and steer right.

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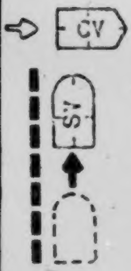
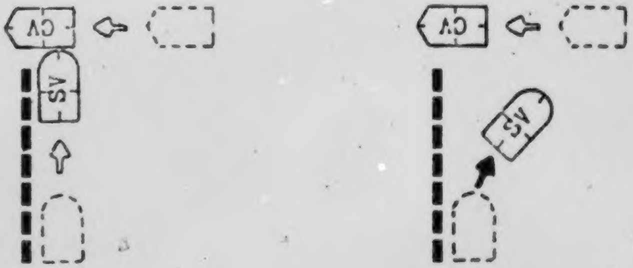
t rear quarter;



chance: Brake
ight ahead.

Figure 3.8: Intersecting vehicle obstacle; Will be struck by subject's vehicle at left rear quarter; Left lane obstructed.



(a) No avoidance response.

(b) Best chance: Brake and steer right.

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① MODULE NO: 3	② MODULE TITLE: Collision Avoidance; Avoid striking an intersecting vehicle.

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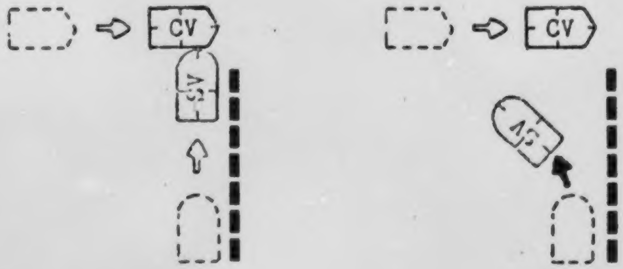
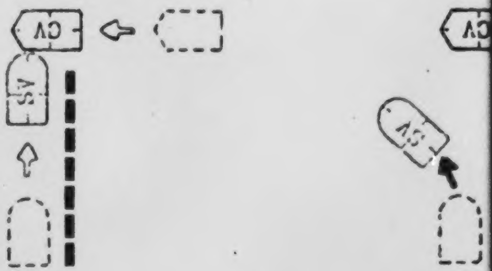
Figure 3.9: Intersecting vehicle obstacle; Will be struck by subject's vehicle at right front quarter; Right lane obstructed.



(a) No avoidance response.

(b) Best chance: Brake and steer left.

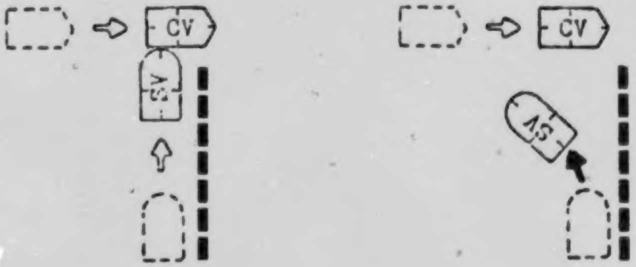
Figure 3.10: Intersecting vehicle obstacle; Wi
by subject's vehicle at left fro
Right lane obstructed.



(a) No avoidance response.

(b) Best chanc
steer left

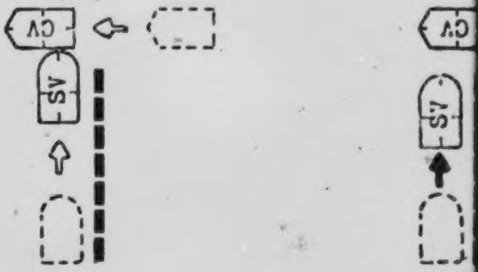
Figure 3.11: Intersecting vehicle obstacle; Will be struck by subject's vehicle at right rear quarter; Right lane obstructed.



(a) No avoidance response.

(b) Best chance: Brake and steer left.

Figure 3.12: Intersecting vehicle obstacle; Wi
by subject's vehicle at left rear
Right lane obstructed.



(a) No avoidance response.

(b) Best chanc
straight

lision Avoidance; Avoid striking an intersecting vehicle.

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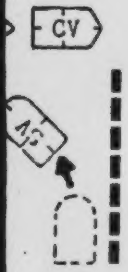
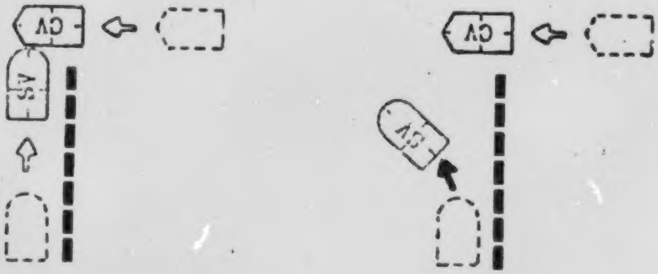
t front quarter;



chance: Brake and
left.

Figure 3.10: Intersecting vehicle obstacle; Will be struck by subject's vehicle at left front quarter; Right lane obstructed.



(a) No avoidance response.

(b) Best chance: Brake and steer left.

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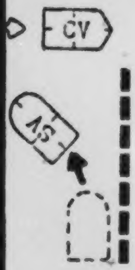
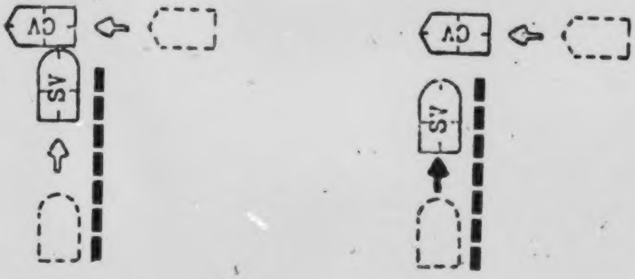


hance: Brake and
left.

Figure 3.12: Intersecting vehicle obstacle; Will be struck by subject's vehicle at left rear quarter; Right lane obstructed.



(a) No avoidance response.

(b) Best chance: Brake and straight ahead.

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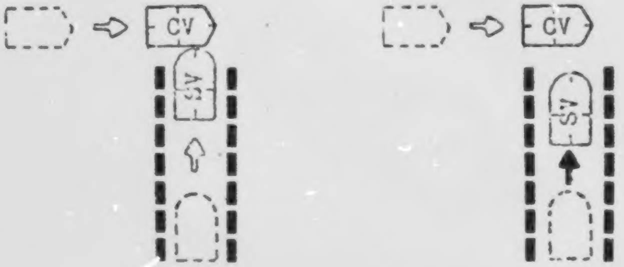
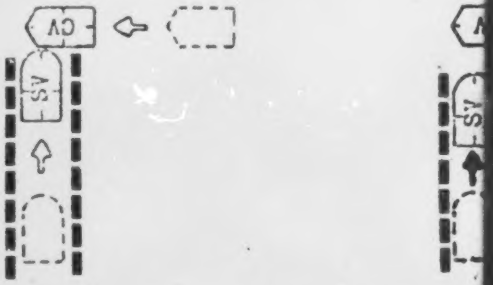
① MODULE NO: 3	② MODULE TITLE: Collision Avoidance; Avoid striking an intersecting vehicle.

Figure 3.13: Intersecting vehicle obstacle; Will be struck by subject's vehicle at right front quarter; Left and right lanes obstructed.



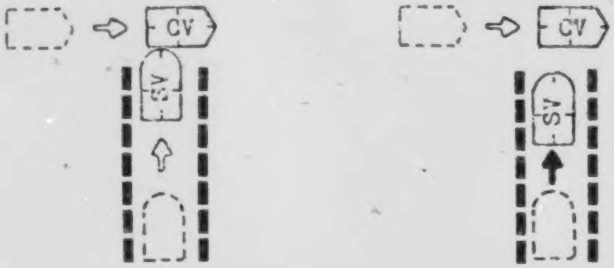
(a) No avoidance response. (b) Best chance: Brake straight ahead.

Figure 3.14: Intersecting vehicle obstacle; W by subject's vehicle at left fr Left and right lanes obstructed.



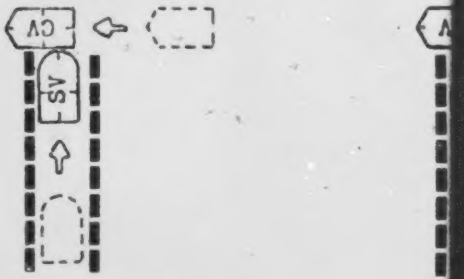
(a) No avoidance response. (b) Best cha straight

Figure 3.15: Intersecting vehicle obstacle; Will be struck by subject's vehicle at right rear quarter; Left and right lanes obstructed.



(a) No avoidance response. (b) Best chance: Brake straight ahead.

Figure 3.16: Intersecting vehicle obstacle; by subject's vehicle at left re Left and right lanes obstructed.



(a) No avoidance response. (b) Best cha straight

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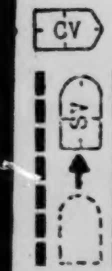
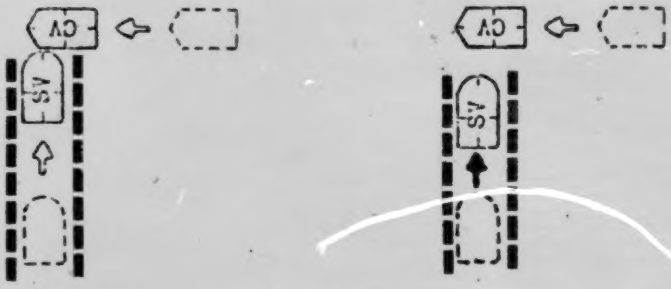
ision Avoidance; Avoid striking an intersecting vehicle.

; Will be struck
front quarter;
ed.



chance: Brake
ight ahead.

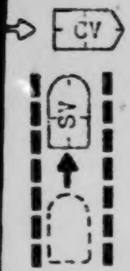
Figure 3.14: Intersecting vehicle obstacle; Will be struck by subject's vehicle at left front quarter; Left and right lanes obstructed.



(a) No avoidance response.

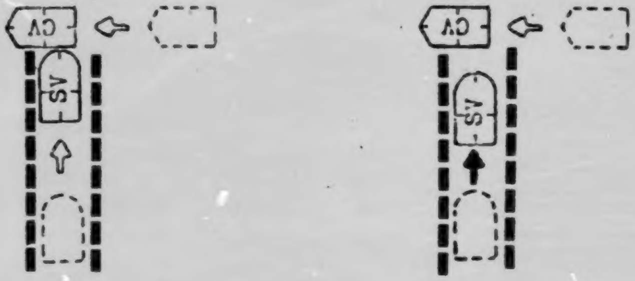
(b) Best chance: Brake straight ahead.

e; Will be struck
t rear quarter;
ed.



chance: Brake
ght ahead.

Figure 3.16: Intersecting vehicle obstacle; Will be struck by subject's vehicle at left rear quarter; Left and right lanes obstructed.



(a) No avoidance response.

(b) Best chance: Brake straight ahead.

Table 3-1: TRAINING AND TESTING MATERIALS, EQUIPMENT, FACILITIES AND STAFF for MODULE # 3, Collision Avoidance, Intersecting Vehicle Obstacle

REQUIREMENT			USE	SUBMODULE																		NOTE
CODE		TITLE		A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	
0001	M	Course Summary	* \#	X X																		
0002	M	Module Summary, Module # 3	* \#	O O	X X							X X										
0003	M	Course Schedule	* \#	O O																		
0004	M	Student Schedule Card	*	O	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
0005	M	Student Master Schedule	\#	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	
0006	M	Range Layout Diagrams	* \#									O O	O X	X X		O X	X X		O O	X X		
0008	M	BMS Instructions	* \#		O X	X			X													
0009	M	Range Instructions/ Safety	* \#									O O	X X	X X		X X	X X		X X	X X		
0010	M	Equipment/Materials Checklist	\#	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	
0012	M	Risk/Waiver Forms	\#	O	X	X	X	X	X	X	X	O	X	X	X	X	X	X	X	X	X	
0013	M	Parental Consent Forms	\#	O	X	X	X	X	X	X	X	O	X	X	X	X	X	X	X	X	X	4
0014	M	Instruction Procedure, Submodule	\#	O	O	O	X	X	O	X	X	O	X	X	X	X	X	X	O	X	X	
0015	M	Content Material, Submodule	\#	O	O	O	X	O	O	X	O	O	O	X	O	O	X	O	O	X	O	
0019	E	Movie Projector, 8mm	\#	O																		3
0020	P	Instructor, Classroom(I)	@	O	O	O	O	O	O	O	O											
0021	P	Instructor,Classroom(II)	@	O	O	O	O		O	O												
0022	E	Bimodal Simulator (BMS)	@		O	O	O		O	O												
0023	M	Maneuvers List,Submodule	* \#	O O	O O	O O			O O			X X	X X			X X			O O			

See page B-12 of specification for explanation of symbols.

Table 3-1: TRAINING AND TESTING MATERIALS, EQUIPMENT, FACILITIES AND STAFF for MODULE # 3 , Collision Avoidance, Intersecting Vehicle Obstacle

REQUIREMENT			USE	SUBMODULE																		NOTE
CODE		TITLE		A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	
0024	M	Maneuvers Description/ Illustration	*	O	O	O	X	X	O	X	X	O	O	X	X	O	X	X	O	X	X	
			#	O	X	X			X			X	X			X			O			
0025	M	Maneuvers Procedures	*	O	O	O			O			O	O			O			O			
			#	O	O	O			O			O	O	X		O	X		O	X		
0027	E	Screen, projection	#	O																		
0030	E	Projector, Movie, 16mm	@	O																		3
0032	M	Attendance Record	#	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	
0033	M	Student Performance Checklist	+			O	O		O	O			O	O		O	O			O		
			#					O			O				O			O			O	
0034	M	Video Tapes (Records)	#					O			O				O			O			O	
0035	P	Range Operations Coordinator	@									O	O	O		O	O			O		
0036	P	Instructor, Range (I)	@									O	O	O	O	O	O	O	O	O	O	
0037	P	Instructor, Range (II)	@									O	O	O		O	O			O		1
0038	F	Range, Auto Driving	@									O	O	O		O	O			O		
0039	E	Auto, Driver Training	@									O	O	O		O	O			O		1
0040	F	Classroom (I)	@	O																		2
0041	F	Classroom (II)	@		O	O	O	O	O	O	O				O			O	O		O	2
0042	E	Range marker cones	@									O	O	O		O	O			O		
0043	E	Range signal flags	@									O	O	O		O	O			O		
0044	M	Range marker stripes	@									O	O	O		O	O			O		
0045	E	Walkie-Talkies	@									O	O	O		O	O			O		
0046	E	Loudspeaker	@									O	O	O		O	O			O		
0047	E	First Aid Kit	@									X	X	X	X	X	X	X	X	X	X	
0048	E	Video Camera	+			O	O		O	O			O	O		O	O			O		
			@									O		O			O			O		

Table 3-1: TRAINING AND TESTING MATERIALS, EQUIPMENT, FACILITIES AND STAFF for MODULE # 3, Collision Avoidance, Intersecting Vehicle Obstacle

REQUIREMENT			USE	SUBMODULE																		NOTE
CODE		TITLE		A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	
0049	E	Video Recorder/Player	+			O	O		O	O			O	O		O	O			O		
			@					O			O			O			O			O		
0050	E	Video Monitor (I)	+			O	O	X	O	O	X		O	O	X	O	O	X		O	X	
0051	E	Video Monitor II	@		O	O	O	O	O	O	O											
0052	E	Crash Helmets	*									O	O	O		O	O			O		
			#									O	O	O		O	O			O		
0053	M	Range Operations Checklist	@									O	O	O		O	O			O		
0054	P	Range Crew	@									O	O	O		O	O			O		
0055	E	Range Support Vehicle	@									O	O	O		O	O			O		
0056	M	Maneuver Sequence List	*	O																		
			#	O			O			O				O			O			O		
0061	M	Simulator Film	#		O	O	O		O	O												
0062	M	Conflict Situation Movie	#	O																		
0063	M	Conflict Presentation Schedule	#				O			O		X	O	O		O	O			O		
0064	M	Conflict Situation Diagrams	*	O	X	X		X	X		X	X			X			X			X	
			#	O	X	X	X	X	X	X	X	X			X			X			X	
0065	E	Surrogate Vehicle	@									O	O	O		O	O			O		1
0066	E	Controller, Surrogate Vehicle	@									O										
			#										O	O		O	O			O		1
0067	E	Emergency Equipment	@									X	X	X		X	X			X		

NOTES: (1) Two are required.

(2) Choice of classroom based on recommended class size.

(3) Choice of projector depends on type of movie film used.

(4) If appropriate.

① MODULE NO: 3	② MODULE TITLE: Collision Avoidance; Avoid striking an intersecting vehicle

Table 3-2: Obstruction variables and best chance avoidance maneuvers for intersecting vehicle obstacle conf

CONFLICT VARIABLES	KEY	MANEUVER ALTERNATIVES BY OBSTRUCTION VARIABLES			
		NO OBSTRUCTIONS	LEFT LANE OBSTRUCTED	RIGHT LANE OBSTRUCTED	LEFT AND RIGHT LANES OBSTRUCTED
Intersecting vehicle approaching from left subject's vehicle will strike on right front quarter (Condition #1a).	BEST CHANCE MANEUVER	Brake and steer left	Brake and steer right	Brake and steer left	Brake straight ahead
	RESULTANT	Avoidance	Severity reduction	Avoidance	Severity reduction
	ILLUSTRATION	FIG. 3.1	FIG. 3.5	FIG. 3.9	FIG. 3.13
Intersecting vehicle approaching from right; subject's vehicle will strike on left front quarter (Condition #1b).	BEST CHANCE MANEUVER	Brake and steer right	Brake and steer right	Brake and steer left	Break straight ahead
	RESULTANT	Avoidance	Avoidance	Severity reduction	Severity reduction
	ILLUSTRATION	FIG. 3.2	FIG. 3.6	FIG. 3.10	FIG. 3.14
Intersecting vehicle approaching from left; subject's vehicle will strike on right rear quarter (Condition #2a).	BEST CHANCE MANEUVER	Brake and steer left	Brake straight ahead	Brake and steer left	Brake straight ahead
	RESULTANT	Avoidance	Avoidance (2)	Avoidance	Avoidance (2)
	ILLUSTRATION	FIG. 3.3	FIG. 3.7	FIG. 3.11	FIG. 3.15
Intersecting vehicle approaching from right; subject's vehicle will strike on left rear quarter (Condition #2b).	BEST CHANCE MANEUVER	Brake and steer right	Brake and steer right	Brake straight ahead	Brake straight ahead
	RESULTANT	Avoidance	Avoidance	Avoidance (2)	Avoidance (2)
	ILLUSTRATION	FIG. 3.4	FIG. 3.8	FIG. 3.12	FIG. 3.16

NOTES: (1) Not applicable since the conflict vehicle is the primary straight-ahead obstruction.
(2) Less likely to achieve complete collision avoidance, but preferable to any turning maneuver.

3.9

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PF-0550-1/4

ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

ion Avoidance; Avoid striking an intersecting vehicle

hance avoidance maneuvers for intersecting vehicle obstacle conflict.

MANEUVER ALTERNATIVES BY OBSTRUCTION VARIABLES

NO OBSTRUCTIONS	LEFT LANE OBSTRUCTED	RIGHT LANE OBSTRUCTED	LEFT AND RIGHT LANES OBSTRUCTED	STRAIGHT AHEAD OBSTRUCTED (1)
Brake and steer left	Brake and steer right	Brake and steer left	Brake straight ahead	N/A
Avoidance	Severity reduction	Avoidance	Severity reduction	
FIG. 3.1	FIG. 3.5	FIG. 3.9	FIG. 3.13	FIG.
Brake and steer right	Brake and steer right	Brake and steer left	Break straight ahead	N/A
Avoidance	Avoidance	Severity reduction	Severity reduction	
FIG. 3.2	FIG. 3.6	FIG. 3.10	FIG. 3.14	FIG.
Brake and steer left	Brake straight ahead	Brake and steer left	Brake straight ahead	N/A
Avoidance	Avoidance (2)	Avoidance	Avoidance (2)	
FIG. 3.3	FIG. 3.7	FIG. 3.11	FIG. 3.15	FIG.
Brake and steer right	Brake and steer right	Brake straight ahead	Brake straight ahead	N/A
Avoidance	Avoidance	Avoidance (2)	Avoidance (2)	
FIG. 3.4	FIG. 3.8	FIG. 3.12	FIG. 3.16	FIG.

t vehicle is the primary straight-ahead obstruction.
collision avoidance, but preferable to any turning maneuver.

red G. R. Hatterick	Approved By:	Page 3-27

MODULE NO: 4

COLLISION AVOIDANCE

AVOID BEING STRUCK BY FOLLOWING VEHICLE

(Following Vehicle Threat)

SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

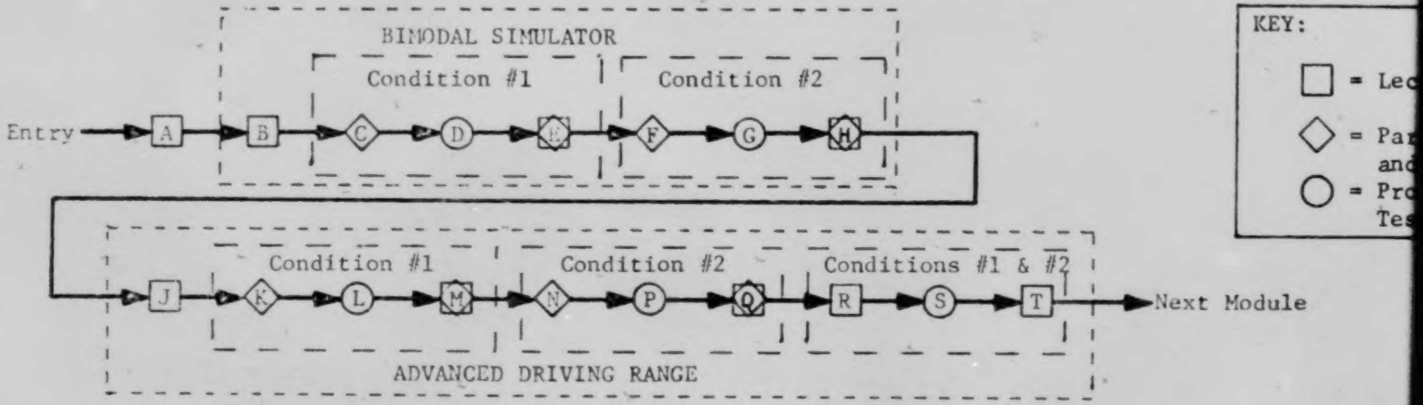
① MODULE NO: 4	② MODULE TITLE: Collision Avoidance; Avoid being struck by following vehicle.

③ PURPOSE OF MODULE: To provide students with the perceptual skills to recognize this type of conflict, maneuvering skills to successfully avoid, or reduce the effects of, a collision.

④ STUDENT ENTRANCE PREREQUISITES: Completion of Module #1; A valid automobile operator's license.

⑤ APPLICABLE INSTRUCTION TECHNIQUES: Classroom lecture; Bimodal simulator; Advanced driving range.

⑥ INSTRUCTIONAL APPROACH: Instruction will be given in a series of submodules:



A: Lecture- Following vehicle threat
B: Bimodal Simulator Demonstration
C: Simulator Practice, Condition #1
D: Simulator Test, Condition #1
E: Simulator Test Debriefing, Condition #1
F: Simulator Practice, Condition #2
G: Simulator Test, Condition #2
H: Simulator Test Debriefing, Condition #2
J: Advanced Driving Range Demonstration
K: Advanced Range Practice, Condition #1
L: Advanced Range Test, Condition #1
M: Advanced Range Test Debriefing, Condition #1
N: Advanced Range Practice, Condition #2
P: Advanced Range Test, Condition #2
Q: Advanced Range Test Debriefing, Condition #2
R: Pre-test Briefing, Advanced Range, Integrated C
S: Advanced Range Test, Integrated Conditions #1 a
T: Advanced Range Test Debriefing, Integrated Cond

CONDITIONS:

#1 - Subject's vehicle will be struck by following
left rear quarter if not successfully avoided

#2 - Subject's vehicle will be struck by following
right rear quarter if not successfully avoide

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PF-0530-1/1

N FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

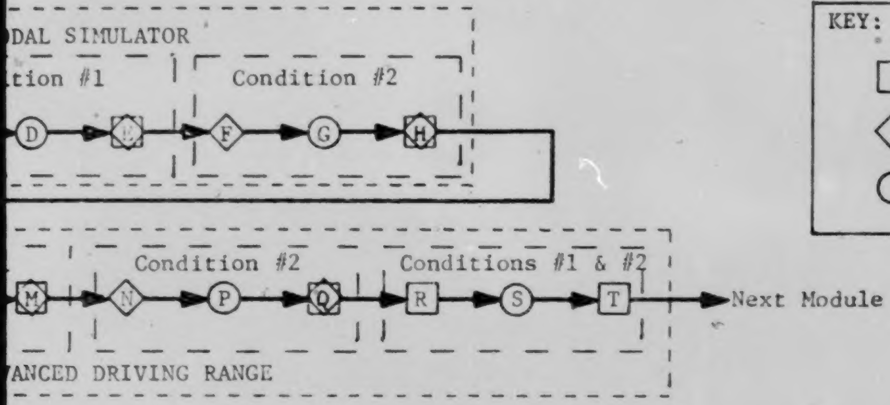
: Collision Avoidance; Avoid being struck by following vehicle.

students with the perceptual skills to recognize this type of conflict, and the skills to successfully avoid, or reduce the effects of, a collision.

: Completion of Module #1; A valid automobile operator's license.

ES: Classroom lecture; Bimodal simulator; Advanced driving range.

ction will be given in a series of submodules:



KEY:

☐ = Lecture

◇ = Participation and Practice

○ = Proficiency Test

reat
on
#1

ndition #1
#2

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ition #1
n #1

M: Advanced Range Test Debriefing, Condition #1
N: Advanced Range Practice, Condition #2
P: Advanced Range Test, Condition #2
Q: Advanced Range Test Debriefing, Condition #2
R: Pre-test Briefing, Advanced Range, Integrated Conditions
S: Advanced Range Test, Integrated Conditions #1 and #2.
T: Advanced Range Test Debriefing, Integrated Conditions #1 & 2

CONDITIONS:

#1 - Subject's vehicle will be struck by following vehicle at left rear quarter if not successfully avoided.

#2 - Subject's vehicle will be struck by following vehicle at right rear quarter if not successfully avoided.

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SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 4

② MODULE TITLE: Collision Avoidance; Avoid being struck by following vehicle.

⑦ SUBMODULE NO: 4.A

⑧ SUBMODULE TITLE: Lecture - Following vehicle threat.

⑨ SUBMODULE OBJECTIVES:

(1) To develop in the student a cognizance of the characteristics of the onset conditions and potentially successful response maneuvers for the following conflict situations:

(a) Following vehicle closing on subject's vehicle; will strike left rear quarter of subject's vehicle (figure 4.1);
(b) Following vehicle closing on subject's vehicle; will strike right rear quarter of subject's vehicle (figure 4.2).

(2) To develop in the student a visual image of the characteristics of the onset conditions, multi-vehicle dynamics, and response maneuvers for the above conflict situations.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will i
the following obstruction variables:*

(a) No obstructions:
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left lane and right lane obstructe

*Obstruction variables are illustrated in fi
through 4.8

⑪ STUDENT MATERIALS: See Table 4-1

⑫ INSTRUCTOR MATERIALS: See Table 4-1

⑬ EVALUATION MATERIALS: See Table 4-1

⑭ SUPPORT R

See Table

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Approved By:

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PF-0530-1/2 (a)

ON FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

Collision Avoidance; Avoid being struck by following vehicle.

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Lecture - Following vehicle threat.

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on subject's vehicle:
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sual image of the
onditions, multi-vehicle
s for the above conflict

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will include the following obstruction variables: *

- (a) No obstructions:
- (b) Left lane obstructed;
- (c) Right lane obstructed;
- (d) Left lane and right lane obstructed.

*Obstruction variables are illustrated in figures 4.1 through 4.8

NSTRUCTOR MATERIALS: Table 4-1	⑬ EVALUATION MATERIALS: See Table 4-1	⑭ SUPPORT REQUIREMENTS: See Table 4-1

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SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 4

② MODULE TITLE: Collision Avoidance; Avoid being struck by following vehicle.

⑦ SUBMODULE NO: 4.B

⑧ SUBMODULE TITLE: Bimodal Simulator Demonstration; Following vehicle threat.

⑨ SUBMODULE OBJECTIVES:

(1) To familiarize the student with the characteristics of the onset conditions and potentially successful response maneuvers, as they will appear in simulation, for the following conflict situations:

- (a) Following vehicle closing on subject's vehicle; will strike left rear quarter of subject's vehicle (figure 4.1);
- (b) Following vehicle closing on subject's vehicle; will strike right rear quarter of subject's vehicle (Figure 4.2).

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will the following obstruction variables:

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lane obstructed;
- (d) Left lane and right lane obstruc

*Obstruction variables are illustrated in f through 4.8

⑪ STUDENT MATERIALS: See Table 4-1

⑫ INSTRUCTOR MATERIALS: See Table 4-1

⑬ EVALUATION MATERIALS: See Table 4-1

⑭ SUPPORT See Tab

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Approved By:

PF-0530-1/2 (a)

ON FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

Collision Avoidance; Avoid being struck by following vehicle.

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Bimodal Simulator Demonstration; Following vehicle threat.

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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will include the following obstruction variables:*

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lane obstructed;
- (d) Left lane and right lane obstructed.

*Obstruction variables are illustrated in figures 4.1 through 4.8

INSTRUCTOR MATERIALS:

e Table 4-1

⑬ EVALUATION MATERIALS:

See Table 4-1

⑭ SUPPORT REQUIREMENTS:

See Table 4-1

Prepared By: G. R. Hatterick

Approved By:

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① MODULE NO: 4	② MODULE TITLE: Collision Avoidance; Avoid being struck by following vehicle.
⑦ SUBMODULE NO: 4.C	⑧ SUBMODULE TITLE: Bimodal Simulator Practice; Following vehicle will strike left rea of subject's car (Condition #1).

⑨ SUBMODULE OBJECTIVES:

(1) Train student drivers to recognize the onset of this conflict situation at the earliest possible moment:

  (a) Following vehicle closing on subject's vehicle; will strike left rear quarter of subject's vehicle (Figure 4.1).

(2) Train student drivers to instantaneously select, from the available choices, the alternative which will most likely avoid, or minimize the effects of, a collision (See Table 4-2);

(3) Train student drivers to effectively implement the alternative selected through evasive maneuvering of their vehicle.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will i the following obstruction variables:*

  (a) No obstructions;
  (b) Left lane obstructed;
  (c) Right lane obstructed;
  (d) Left lane and right lane obstruct

*Obstruction variables are illustrated in fi through 4.8

⑪ STUDENT MATERIALS:	⑫ INSTRUCTOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPORT
See Table 4-1	See Table 4-1	See Table 4-1	See Tabl

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FF-0530-1/2 (a)

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FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

lision Avoidance; Avoid being struck by following vehicle.

imodal Simulator Practice; Following vehicle will strike left rear quarter
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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will include the following obstruction variables:*

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left lane and right lane obstructed.

*Obstruction variables are illustrated in figures 4.1 through 4.8

RUCTOR MATERIALS: able 4-1	⑬ EVALUATION MATERIALS: See Table 4-1	⑭ SUPPORT REQUIREMENTS: See Table 4-1

epared : G. R. Hatterick	Approved By:	Page 4-4

SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 4

② MODULE TITLE: Collision Avoidance; Avoid being struck by following vehicle.

⑦ SUBMODULE NO: 4.D

⑧ SUBMODULE TITLE: Bimodal Simulator Test; Following vehicle will strike left rear qu of subject's car (Condition #1).

⑨ SUBMODULE OBJECTIVES:

(1) To ascertain that each student has learned to recognize the precursor conditions of this conflict situation as soon as they appear;

   (a) Following vehicle closing on subject's vehicle; will strike left rear quarter of subject's vehicle (Figure 4.1).

(2) To determine that the student has learned to select the most feasible alternative available to either avoid, or reduce the effects of, a collision resulting from this conflict.

(3) To determine that the student has learned to effectively implement the avoidance maneuver selected in this conflict situation.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will i the following obstruction variables:*

   (a) No obstructions ;
   (b) Left lane obstructed;
   (c) Right lane obstructed;
   (d) Left lane and right lane obstructe

*Obstruction variables are illustrated in fig through 4.8

⑪ STUDENT MATERIALS: See Table 4-1

⑫ INSTRUCTOR MATERIALS: See Table 4-1

⑬ EVALUATION MATERIALS: See Table 4-1

⑭ SUPPORT R See Table

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Revision No: 2

Prepared By: G. R. Hatterick

Approved By:

Pa

PF-0530-1/2 (a)

R ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

ision Avoidance; Avoid being struck by following vehicle.

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ject's vehicle;
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collision resulting

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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will include the following obstruction variables:*

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lane obstructed;
- (d) Left lane and right lane obstructed.

*Obstruction variables are illustrated in figures 4.1 through 4.8

UCTOR MATERIALS:

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⑬ EVALUATION MATERIALS:

See Table 4-1

⑭ SUPPORT REQUIREMENTS:

See Table 4-1

pared G. R. Hatterick

Approved By:

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SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 4

② MODULE TITLE: Collision Avoidance; Avoid being struck by following vehicle.

⑦ SUBMODULE NO: 4.E

⑧ SUBMODULE TITLE: Bimodal Simulator Test Debriefing; Following vehicle will impac
quarter of subject's vehicle (Condition #1).

⑨ SUBMODULE OBJECTIVES:

(1) To provide to the student an immediate assessment of the level of performance achieved during the test for this conflict situation:
   (a) Following vehicle closing on subject's vehicle; will strike left rear quarter of subject's vehicle (Figure 4.1).

(2) To provide to the student specific comments regarding deficiencies in performance and the corrective action required, and instances of superior performance.

(3) To gain from the student an immediate appraisal of difficulties encountered and reactions to the test.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will
the following obstruction variables:
   (a) No obstructions;
   (b) Left lane obstructed;
   (c) Right lane obstructed;
   (d) Left lane and right lane obstruc

*Obstruction variables are illustrated in
through 4.8

⑪ STUDENT MATERIALS:	⑫ INSTRUCTOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPORT
See Table 4-1	See Table 4-1	See Table 4-1	See Tab

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PF-0530-1/2 (a)

CATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

LE: Collision Avoidance; Avoid being struck by following vehicle.

TITLE: Bimodal Simulator Test Debriefing; Following vehicle will impact left rear quarter of subject's vehicle (Condition #1).

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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will include the following obstruction variables: *

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left lane and right lane obstructed.

*Obstruction variables are illustrated in figures 4.1 through 4.8

INSTRUCTOR MATERIALS:

See Table 4-1

⑬ EVALUATION MATERIALS:

See Table 4-1

⑭ SUPPORT REQUIREMENTS:

See Table 4-1

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Approved By:

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① MODULE NO: 4	② MODULE TITLE: Collision Avoidance; Avoid being struck by following vehicle.
⑦ SUBMODULE NO: 4.F	⑧ SUBMODULE TITLE: Bimodal Simulator Practice; Following vehicle will strike right of subject's car (Condition #2)

⑨ SUBMODULE OBJECTIVES:

(1) Train student drivers to recognize the onset of this conflict situation at the earliest possible moment;

- (a) Following vehicle closing on subject's vehicle; will strike right rear quarter of subject's vehicle (Figure 4.2).

(2) Train student drivers to instanteously select, from the available choices, the alternative which will most likely avoid, or minimize the effects of, a collision. (See Table 4-2)

(3) Train student drivers to effectively implement the alternative selected through evasive maneuvering of their vehicle.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will the following obstruction variables:

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lane obstructed;
- (d) Left lane and right lane obstruc

*Obstruction variables are illustrated in through 4.8

⑪ STUDENT MATERIALS: See Table 4-1	⑫ INSTRUCTOR MATERIALS: See Table 4-1	⑬ EVALUATION MATERIALS: See Table 4-1	⑭ SUPPORT See Tab

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ION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

Collision Avoidance; Avoid being struck by following vehicle.

TLE: Bimodal Simulator Practice: Following vehicle will strike right rear quarter of subject's car (Condition #2)

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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will include the following obstruction variables:*

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lane obstructed;
- (d) Left lane and right lane obstructed.

*Obstruction variables are illustrated in figures 4.1 through 4.8

INSTRUCTOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPORT REQUIREMENTS:
See Table 4-1	See Table 4-1	See Table 4-1

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SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 4

② MODULE TITLE: Collision Avoidance; Avoid being struck by following vehicle.

⑦ SUBMODULE NO: 4.G

⑧ SUBMODULE TITLE: Bimodal Simulator Test; Following vehicle will strike right rear qu
subject's car (Condition #2)

⑨ SUBMODULE OBJECTIVES:

(1) To ascertain that each student has learned to recognize the precursor conditions of this conflict situation as soon as they appear:

- (a) Following vehicle closing on subject's vehicle will strike right rear quarter of subject's vehicle (Figure 4.2).

(2) To determine that the student has learned to select the most feasible alternative available to either avoid, or reduce the effects of, a collision resulting from this conflict.

(3) To determine that the student has learned to effectively implement the avoidance maneuver selected in this conflict situation.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will i
the following obstruction variables:*

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lane obstructed;
- (d) Left lane and right lane obstructe

*Obstruction variables are illustrated in fig
through 4.8

⑪ STUDENT MATERIALS: See Table 4-1

⑫ INSTRUCTOR MATERIALS: See Table 4-1

⑬ EVALUATION MATERIALS: See Table 4-1

⑭ SUPPORT RE
See Table

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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will include the following obstruction variables:*

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lane obstructed;
- (d) Left lane and right lane obstructed.

*Obstruction variables are illustrated in figures 4.1 through 4.8

STRUCTOR MATERIALS: See Table 4-1	⑬ EVALUATION MATERIALS: See Table 4-1	⑭ SUPPORT REQUIREMENTS: See Table 4-1

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SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 4

② MODULE TITLE: Collision Avoidance; Avoid being struck by following vehicle.

⑦ SUBMODULE NO: 4.H

⑧ SUBMODULE TITLE: Bimodal Simulator Test Debriefing; Following vehicle will impact rig
quarter of subject's vehicle (Condition #2).

⑨ SUBMODULE OBJECTIVES:

(1) To provide to the student an immediate assessment of the level of performance achieved during the test for this conflict situation;

(a) Following vehicle closing on subject's vehicle; will strike right rear quarter of subject's vehicle (Figure 4.2).

(2) To provide to the student specific comments regarding deficiencies in performance and the corrective action required, and instances of superior performance.

(3) To gain from the student an immediate appraisal of difficulties encountered and reactions to the test.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will i
the following obstruction variables:*

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left lane and right lane obstructe

*Obstruction variables are illustrated in fi
through 4.3

⑪ STUDENT MATERIALS:	⑫ INSTRUCTOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPORT RE
See Table 4-1	See Table 4-1	See Table 4-1	See Table

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ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will include the following obstruction variables:*

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left lane and right lane obstructed.

*Obstruction variables are illustrated in figures 4.1 through 4.3

OR MATERIALS:

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⑬ EVALUATION MATERIALS:

See Table 4-1

⑭ SUPPORT REQUIREMENTS:

See Table 4-1

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SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 4

② MODULE TITLE: Collision Avoidance; Avoid being struck by following vehicle.

⑦ SUBMODULE NO: 4.J

⑧ SUBMODULE TITLE: Advanced Driving Range Demonstration; Following vehicle threat.

⑨ SUBMODULE OBJECTIVES:

(1) To familiarize the student with the characteristics of the onset conditions and potentially successful response maneuvers, as they will appear on the driving range, for the following conflict situations:

(a) Following vehicle closing on subject's vehicle; will strike left rear quarter of subject's vehicle (figure 4.1);

(b) Following vehicle closing on subject's vehicle; will strike right rear quarter of subject's vehicle (figure 4.2).

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will
the following obstruction variables:

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left lane and right lane obstruc

(2) Only student participants and require
staff will be permitted on the range
submodule.

(3) All range safety equipment and proced
verified prior to initiating demonstr

(4) Range Safety Monitor must be on duty
during the use of the range.

*Obstruction variables are illustrated in fi
through 4.8

⑪ STUDENT MATERIALS: See Table 4-1

⑫ INSTRUCTOR MATERIALS: See Table 4-1

⑬ EVALUATION MATERIALS: See Table 4-1

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See Table

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ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will include the following obstruction variables:*

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lane obstructed;
- (d) Left lane and right lane obstructed.

(2) Only student participants and required instructor staff will be permitted on the range during this submodule.

(3) All range safety equipment and procedures will be verified prior to initiating demonstration.

(4) Range Safety Monitor must be on duty at all times during the use of the range.

*Obstruction variables are illustrated in figures 4.1 through 4.8

MATERIALS: e 4-1	⑬ EVALUATION MATERIALS: See Table 4-1	⑭ SUPPORT REQUIREMENTS: See Table 4-1

. R. Hatterick	Approved By:	Page 4-10

① MODULE NO:
4

② MODULE TITLE:
Collision Avoidance; Avoid being struck by following vehicle.

⑦ SUBMODULE NO:
4.K.

⑧ SUBMODULE TITLE: Advanced Driving Range Practice; Following vehicle will strike le
of subject's car (Condition #1).

⑨ SUBMODULE OBJECTIVES:

(1) Train student drivers to recognize the onset of this conflict situation at the earliest possible moment;

(a) Following vehicle closing on subject's vehicle; will strike left rear quarter of subject's vehicle (Figure 4.1).

(2) Train student drivers to instantaneously select, from the available choices, the alternative which will most likely avoid, or minimize the effects of a collision; (See Table 4-2)

(3) Train student drivers to effectively implement the alternative selected through evasive maneuvering of their vehicle.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Only student participants and requir
staff will be permitted on the range
submodule.

(2) All range safety equipment and proce
verified prior to initiating student
sessions.

(3) Range Safety Monitor must be on duty
during the use of the range.

(4) Each of the conflict situations will
following obstruction variables: *

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left land and right lane obstruc

*Obstruction variables are illustrated in
through 4.8

⑪ STUDENT MATERIALS:
See Table 4-1

⑫ INSTRUCTOR MATERIALS:
See Table 4-1

⑬ EVALUATION MATERIALS:
See Table 4-1

⑭ SUPPORT
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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Only student participants and required instructor staff will be permitted on the range during this submodule.

(2) All range safety equipment and procedures will be verified prior to initiating student practice sessions.

(3) Range Safety Monitor must be on duty at all times during the use of the range.

(4) Each of the conflict situations will include the following obstruction variables: *

  (a) No obstructions;
  (b) Left lane obstructed;
  (c) Right lane obstructed;
  (d) Left land and right lane obstructed.

*Obstruction variables are illustrated in figures 4.1 through 4.8

OR MATERIALS: e 4-1	⑬ EVALUATION MATERIALS: See Table 4-1	⑭ SUPPORT REQUIREMENTS: See Table 4-1

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SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 4	② MODULE TITLE: Collision Avoidance; Avoid being struck by following vehicle.
⑦ SUBMODULE NO: 4.E.	⑧ SUBMODULE TITLE: Advanced Driving Range Test; Following vehicle will strike left re subject's car (Condition #1).

⑨ SUBMODULE OBJECTIVES:

(1) To ascertain that each student has learned to recognize the precursor conditions of this conflict situation as soon as they appear:

- (a) Following vehicle closing on subject's vehicle: will strike left rear quarter of subject's vehicle (Figure 4.1).

(2) To determine that the [illegible]dent has learned to select the most feasi[illegible]lternative available to either avoid, or re[illegible] the effects of, a collision resulting fro[illegible]his conflict;

(3) To determine that the student has learned to effectively implement the avoidance maneuver selected in this conflict situation.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Only student participants and require
staff will be permitted on the range
submodule.

(2) All range safety equipment and proced
verified prior to initiating student

(3) Range Safety Monitor must be on duty
during the use of the range.

(4) Each of the conflict situations will
following obstruction variables: *

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lane obstructed;
- (d) Left lane and right lane obstruct

*Obstruction variables are illustrated in fi
through 4.8

⑪ STUDENT MATERIALS:	⑫ INSTRUCTOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPORT RE
See Table 4-1	See Table 4-1	See Table 4-1	See Table

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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Only student participants and required instructor staff will be permitted on the range during this submodule.

(2) All range safety equipment and procedures will be verified prior to initiating student test sessions.

(3) Range Safety Monitor must be on duty at all times during the use of the range.

(4) Each of the conflict situations will include the following obstruction variables: *

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left lane and right lane obstructed.

*Obstruction variables are illustrated in figures 4.1 through 4.8

OR MATERIALS: e 4-1	**⑬ EVALUATION MATERIALS:** See Table 4-1	**⑭ SUPPORT REQUIREMENTS:** See Table 4-1

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① MODULE NO:
4

② MODULE TITLE:
Collision Avoidance; Avoid being struck by following vehicle.

⑦ SUBMODULE NO:
4.M

⑧ SUBMODULE TITLE: Advanced Driving Range Test Debriefing; Following vehicle will im
quarter of subject's vehicle (Condition #1).

⑨ SUBMODULE OBJECTIVES:

(1) To provide the student an immediate assessment of the level of performance achieved during the test, for this conflict situation;

(a) Following vehicle closing on subject's vehicle; will strike left rear quarter of subject's vehicle (Figure 4.1).

(2) To provide to the student specific comments regarding deficiencies in performance and the corrective action required, and instances of superior performance.

(3) To gain from the student an immediate appraisal of difficulties encountered and reactions to the test.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will
the following obstruction variables:*

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left lane and right lane obstruct

*Obstruction variables are illustrated in f
through 4.8

⑪ STUDENT MATERIALS:
See Table 4-1

⑫ INSTRUCTOR MATERIALS:
See Table 4-1

⑬ EVALUATION MATERIALS:
See Table 4-1

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ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will include the following obstruction variables:*

  (a) No obstructions;
  (b) Left lane obstructed;
  (c) Right lane obstructed;
  (d) Left lane and right lane obstructed.

*Obstruction variables are illustrated in figures 4.1 through 4.8

TOR MATERIALS: Table 4-1	⑬ EVALUATION MATERIALS: See Table 4-1	⑭ SUPPORT REQUIREMENTS: See Table 4-1

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SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 4

② MODULE TITLE: Collison Avoidance; Avoid being struck by following vehicle.

⑦ SUBMODULE NO: 4.N.

⑧ SUBMODULE TITLE: Advanced Driving Range Practice; Following vehicle will strike rig quarter of subject's car (Condition #2).

⑨ SUBMODULE OBJECTIVES:

(1) Train student drivers to recognize the onset of this conflict situation at the earliest possible moment:

  (a) Following vehicle closing on subject's vehicle; will strike right rear quarter of subject's vehicle (Figure 4.2).

(2) Train student drivers to instantaneously select from the available choices, the alternative which will most likely avoid, or minimize the effects of, a collision; (See Table 4-2)

(3) Train student drivers to effectively implement the alternative selected through evasive maneuvering of their vehicle.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Only student participants and required i staff will be permitted on the range dur submodule.

(2) All range safety equipment and procedure verified prior to initiating student pra sessions.

(3) Range Safety Monitor must be on duty at during the use of the range.

(4) Each of the conflict situations will incl following obstruction variables: *

  (a) No obstructions;
  (b) Left lane obstructed;
  (c) Right lane obstructed;
  (d) Left lane and right lane obstructed.

*Obstruction variables are illustrated in fig through 4.8

⑪ STUDENT MATERIALS:	⑫ INSTRUCTOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPORT REQ
See Table 4-1	See Table 4-1	See Table 4-1	See Table 4

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ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Only student participants and required instructor staff will be permitted on the range during this submodule.

(2) All range safety equipment and procedures will be verified prior to initiating student practice sessions.

(3) Range Safety Monitor must be on duty at all times during the use of the range.

(4) Each of the conflict situations will include the following obstruction variables: *

(a) No obstructions:
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left lane and right lane obstructed.

*Obstruction variables are illustrated in figures 4.1 through 4.8

TOR MATERIALS: e 4-1	⑬ EVALUATION MATERIALS: See Table 4-1	⑭ SUPPORT REQUIREMENTS: See Table 4-1
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SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 4	② MODULE TITLE: Collision Avoidance; Avoid being struck by following vehicle.
⑦ SUBMODULE NO: 4.P.	⑧ SUBMODULE TITLE: Advanced Driving Range Test; Following vehicle will strike right of subject's car (Condition #2).

⑨ SUBMODULE OBJECTIVES:

(1) To ascertain that each student has learned to recognize the precursor conditions of this conflict situation as soon as they appear:

(a) Following vehicle closing on subject's vehicle; will strike right rear quarter of subject's vehicle (Figure 4.2).

(2) To determine that the student has learned to select the most feasible alternative available to either avoid, or reduce the effects of, a collision resulting from this conflict;

(3) To determine that the student has learned to effectively implement the avoidance maneuver selected in this conflict situation.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Only student participants and required staff will be permitted on the range d submodule.

(2) All range safety equipment and procedu verified prior to initiating student t

(3) Range Safety Monitor must be on duty a during the use of the range.

(4) Each of the conflict situations will i following obstruction variables: *

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left lane and right lane obstructe

*Obstruction variables are illustrated in fi through 4.8

⑪ STUDENT MATERIALS: See Table 4-1	⑫ INSTRUCTOR MATERIALS: See Table 4-1	⑬ EVALUATION MATERIALS: See Table 4-1	⑭ SUPPORT R See Table

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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Only student participants and required instructor staff will be permitted on the range during this submodule.

(2) All range safety equipment and procedures will be verified prior to initiating student test sessions.

(3) Range Safety Monitor must be on duty at all times during the use of the range.

(4) Each of the conflict situations will include the following obstruction variables: *

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left lane and right lane obstructed.

*Obstruction variables are illustrated in figures 4.1 through 4.8

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⑬ EVALUATION MATERIALS:

See Table 4-1

⑭ SUPPORT REQUIREMENTS:

See Table 4-1

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SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 4	② MODULE TITLE: Collision Avoidance; Avoid being struck by following vehicle.
⑦ SUBMODULE NO: 4.Q	⑧ SUBMODULE TITLE: Advanced Driving Range Test Debriefing; Following vehicle will imp quarter of subject's vehicle (Condition #2).

⑨ SUBMODULE OBJECTIVES:

(1) To provide to the student an immediate assessment of the level of performance achieved during the test, for this conflict;

(a) Following vehicle closing on subject's vehicle; will strike right rear quarter of subject's vehicle (Figure 4.2).

(2) To provide to the student specific comments regarding deficiencies in performance and the corrective action required, and instances of superior performance;

(3) To gain from the student an immediate appraisal of difficulties incountered and reactions to the test.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will
the following obstruction variables:

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left lane and right lane obstruc

*Obstruction variables are illustrated in f
through 4.8

⑪ STUDENT MATERIALS: See Table 4-1	⑫ INSTRUCTOR MATERIALS: See Table 4-1	⑬ EVALUATION MATERIALS: See Table 4-1	⑭ SUPPORT See Tabl

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R ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

ion Avoidance; Avoid being struck by following vehicle.

anced Driving Range Test Debriefing; Following vehicle will impact right rear
rter of subject's vehicle (Condition #2).

te assessment
during the

ject's vehicle;
f subject's

omments regard-
the corrective
perior perform-

appraisal
ions to the

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will include the following obstruction variables:*

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left lane and right lane obstructed.

*Obstruction variables are illustrated in figures 4.1 through 4.8

TOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPORT REQUIREMENTS:
Table 4-1	See Table 4-1	See Table 4-1

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SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 4

② MODULE TITLE: Collision Avoidance; Avoid being struck by following vehicle.

⑦ SUBMODULE NO: 4.R

⑧ SUBMODULE TITLE: Pre-Test Briefing, Advanced Driving Range Test; Following vehicle either the left rear (Condition #1) or right rear (Condition #2) of the subj

⑨ SUBMODULE OBJECTIVES:

(1) To prepare the student for conduct of the integrated testing submodule by describing the scope of the test, reviewing the characteristics of the included conflict situations, and describing the maneuvers most likely to be successful for the following conflict situations;

- (a) Following vehicle closing on subject's vehicle; will strike left rear quarter of subject's vehicle (figure 4.1);
- (b) Following vehicle closing on subject's vehicle; will strike right rear quarter of subject's vehicle (figure 4.2).

(2) To assure that the sutdent comprehends the need to select the most appropriate course of evasive action based on the specific characteristics of the conflict situations confronting him.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will the following obstruction variables:*

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lane obstructed;
- (d) Left lane and right lane obstruc

*Obstruction variables are illustrated in f through 4.8

⑪ STUDENT MATERIALS:	⑫ INSTRUCTOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPORT
See Table 4-1	See Table 4-1	See Table 4-1	See Tabl

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on Avoidance; Avoid being struck by following vehicle.

e-Test Briefing, Advanced Driving Range Test; Following vehicle may strike
ft rear (Condition #1) or right rear (Condition #2) of the subject vehicle.

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him.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will include the following obstruction variables:*

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left lane and right lane obstructed.

*Obstruction variables are illustrated in figures 4.1 through 4.8

CTOR MATERIALS: Table 4-1	⑬ EVALUATION MATERIALS: See Table 4-1	⑭ SUPPORT REQUIREMENTS: See Table 4-1

pared G. R. Hatterick	Approved By:	Page 4-17

SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 4

② MODULE TITLE: Collision Avoidance; Avoid being struck by following vehicle.

⑦ SUBMODULE NO: 4.S.

⑧ SUBMODULE TITLE: Integrated Advanced Range Test: Following vehicle may strike either
rear (Condition #1) or the right rear (Condition #2) of the subject'

⑨ SUBMODULE OBJECTIVES:

(1) To ascertain that each student has learned to recognize the precursor conditions of these conflict situations as soon as they appear:

- (a) Following vehicle closing on subject's vehicle; will strike left rear quarter of subject's vehicle (figure 4.1):
- (b) Following vehicle closing on subject's vehicle; will strike right rear quarter of subject's vehicle (figure 4.2).

(2) To determine that the student has learned to select the most feasible alternative available to either avoid, or reduce the effects of, a collision resulting from this conflict;

(3) To determine that the student has learned to effectively implement the avoidance maneuver selected in this conflict situation.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Only student participants and required i
staff will be permitted on the range dur
submodule.

(2) All range safety equipment and procedure
verified prior to initiating student tes

(3) Range Safety Monitor must be on duty at
during the use of the range.

(4) Each of the conflict situations will inc
following obstruction variables: *

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lane obstructed;
- (d) Left lane and right lane obstructed.

*Obstruction variables are illustrated in figu
through 4.8

⑪ STUDENT MATERIALS: See Table 4-1

⑫ INSTRUCTOR MATERIALS: See Table 4-1

⑬ EVALUATION MATERIALS: See Table 4-1

⑭ SUPPORT REQ
See Table 4

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ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

on Avoidance; Avoid being struck by following vehicle.

grated Advanced Range Test; Following vehicle may strike either the left
(Condition #1) or the right rear (Condition #2) of the subject's car.

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f these conflict

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subject's

ject's vehicle;
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arned to select
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arned to
maneuver

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Only student participants and required instructor staff will be permitted on the range during this submodule.

(2) All range safety equipment and procedures will be verified prior to initiating student test sessions.

(3) Range Safety Monitor must be on duty at all times during the use of the range.

(4) Each of the conflict situations will include the following obstruction variables: *

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lane obstructed;
- (d) Left lane and right lane obstructed.

*Obstruction variables are illustrated in figures 4.1 through 4.8

OR MATERIALS: 4-1	⑬ EVALUATION MATERIALS: See Table 4-1	⑭ SUPPORT REQUIREMENTS: See Table 4-1

d G. R. Hatterick	Approved By:	Page 4-18

SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 4	② MODULE TITLE: Collision Avoidance; Avoid being struck by following vehicle.
⑦ SUBMODULE NO: 4.T	⑧ SUBMODULE TITLE: Integrated Advanced Driving Range Test Debriefing; Following vehic either left rear (Condition #1) or right rear (Condition #2) of su

⑨ SUBMODULE OBJECTIVES:

(1) To provide to the student an immediate assessment of the level of performance achieved during the test, for the following conflicts:

- (a) Following vehicle closing on subject's vehicle; will strike left rear quarter of subject's vehicle (figure 4.1);
- (b) Following vehicle closing on subject's vehicle; will strike right rear quarter of subject's vehicle (figure 4.2).

(2) To provide to the student specific comments regarding deficiencies in performance and the corrective action required, and instances of superior performance.

(3) To gain from the student an immediate appraisal of difficulties encountered and reactions to the test.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will
the following obstruction variables:*

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lane obstructed;
- (d) Left lane and right lane obstructe

*Obstruction variables are illustrated in fi
through 4.8

⑪ STUDENT MATERIALS:	⑫ INSTRUCTOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPORT R
See Table 4-1	See Table 4-1	See Table 4-1	See Table

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PF-0530-1/2 (a)

ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

Avoidance; Avoid being struck by following vehicle.

egrated Advanced Driving Range Test Debriefing; Following vehicle will impact
her left rear (Condition #1) or right rear (Condition #2) of subject's vehicle

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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will include the following obstruction variables:*

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lane obstructed;
- (d) Left lane and right lane obstructed.

*Obstruction variables are illustrated in figures 4.1 through 4.8

OR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPORT REQUIREMENTS:
able 4-1	See Table 4-1	See Table 4-1

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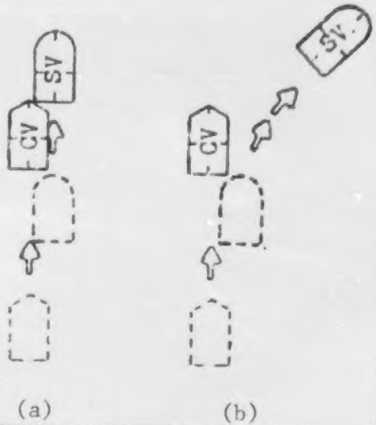
① MODULE NO: 4.	② MODULE TITLE: Collision Avoidance; Avoid being struck by following vehicle.

Figure 4.1: Following vehicle threat to left rear quarter of subject's vehicle; no obstructions.

(a) No avoidance response.

(b) Best chance: Accelerate and steer right.

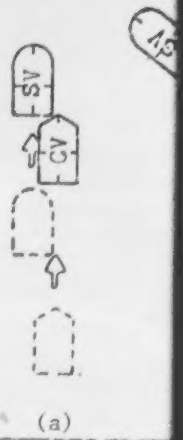


(a) (b)

Figure 4.2: Following vehicle threat to right rear quarter of subject's vehicle; no obstructions.

(a) No avoidance response.

(b) Best chance: Accelerate and steer left.

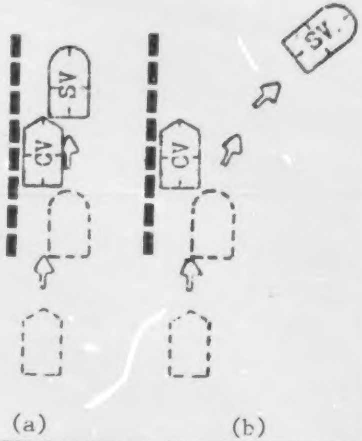


(a)

Figure 4.3: Following vehicle threat to left rear quarter of subject's vehicle; left lane obstructed.

(a) No avoidance response.

(b) Best chance: Accelerate and steer right.

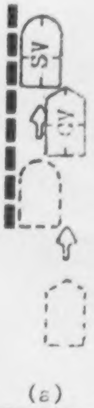


(a) (b)

Figure 4.4: Following vehicle threat to right rear quarter of subject's vehicle; left lane obstructed.

(a) No avoidance response.

(b) Best chance: Accelerate and steer right



(a)

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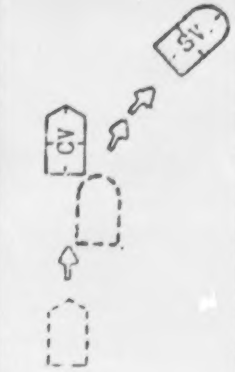
ision Avoidance; Avoid being struck by following vehicle.

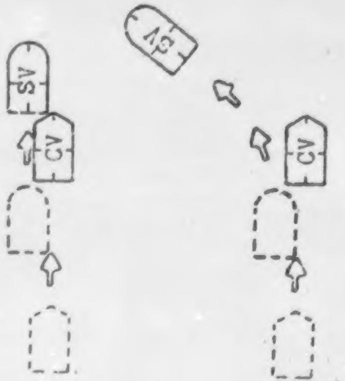


(b)

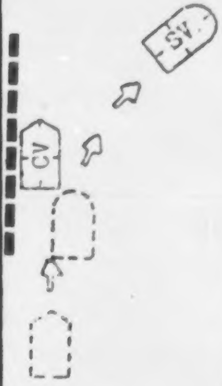
Figure 4.2: Following vehicle threat to right rear quarter of subject's vehicle; no obstructions.

(a) No avoidance response.

(b) Best chance: Accelerate and steer left.



(a) (b)

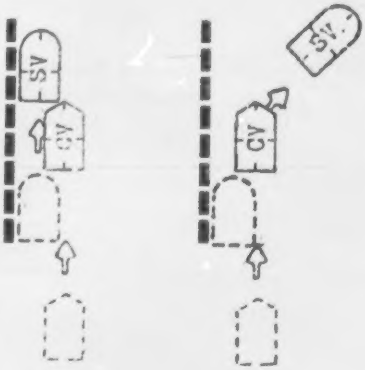


(b)

Figure 4.4: Following vehicle threat to right rear quarter of subject's vehicle; left lane obstructed.

(a) No avoidance response.

(b) Best chance: Accelerate and steer right



(a) (b)

ed G. R. Hatterick	Approved By:	Page: 4-20

① MODULE NO: 4.	② MODULE TITLE: Collision Avoidance; Avoid being struck by following vehicle.

Figure 4.5: Following vehicle threat to left rear quarter of subject's vehicle; right lane obstructed.

(a) No avoidance response.

(b) Best chance: Accelerate and steer left.

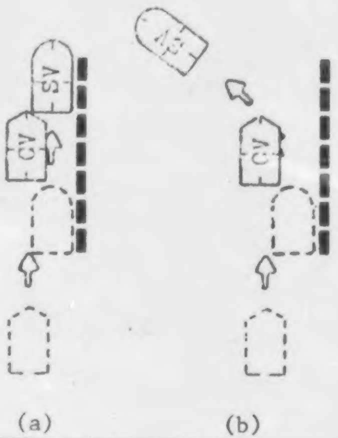


Figure 4.6: Following vehicle threat to right rear quarter of subject's vehicle; right lane obstructed.

(a) No avoidance response.

(b) Best chance: Accelerate and steer left.

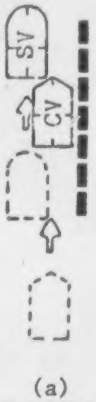


Figure 4.7: Following vehicle threat to left rear quarter of subject's vehicle; left and right lane obstructed.

(a) No avoidance response.

(b) Best chance: Accelerate straight ahead.

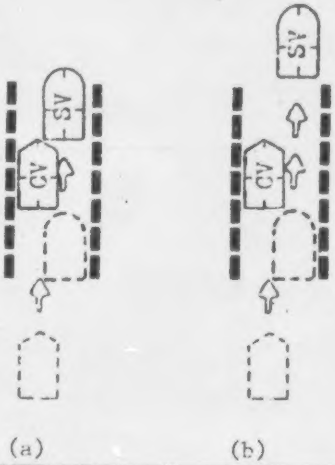
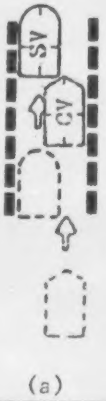


Figure 4.8: Following vehicle threat to right rear quarter of subject's vehicle; left and right lane obstructed.

(a) No avoidance response.

(b) Best chance: Accelerate straight ahead.



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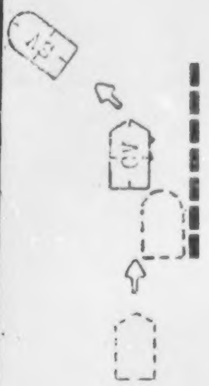
ision Avoidance; Avoid being struck by following vehicle.

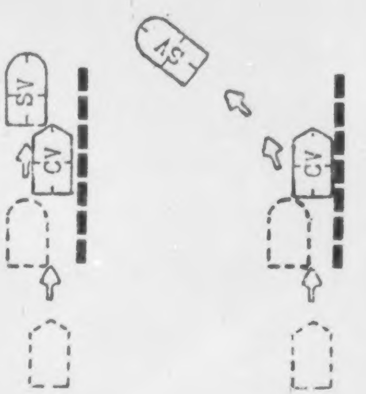


(b)

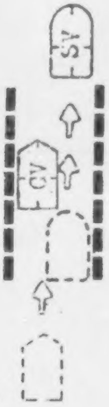
Figure 4.6: Following vehicle threat to right rear quarter of subject's vehicle; right lane obstructed.

(a) No avoidance response.

(b) Best chance: Accelerate and steer left.



(a) (b)

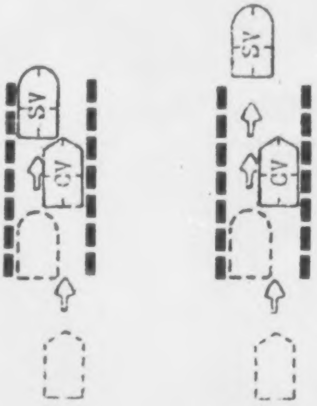


(b)

Figure 4.8: Following vehicle threat to right rear quarter of subject's vehicle; left and right lane obstructed.

(a) No avoidance response.

(b) Best chance: Accelerate straight ahead.



(a) (b)

Table 4-1: TRAINING AND TESTING MATERIALS, EQUIPMENT, FACILITIES AND STAFF for MODULE # 4, Collision Avoidance, Following Vehicle Threat

REQUIREMENT			USE	SUBMODULE																		NOTE
CODE		TITLE		A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	
0001	M	Course Summary	* \#	X X																		
0002	M	Module Summary, Module # 4	* \#	O O	X X							X X										
0003	M	Course Schedule	* \#	O O																		
0004	M	Student Schedule Card	*	O	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
0005	M	Student Master Schedule	#	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	
0006	M	Range Layout Diagrams	* \#									O O	O X	X X		O X	X X		O O	X X		
0008	M	BMS Instructions	* \#		O X	X			X													
0009	M	Range Instructions/ Safety	* \#									O O	X X	X X		X X	X X		X X	X X		
0010	M	Equipment/Materials Checklist	#	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	
0012	M	Risk/Waiver Forms	#	O	X	X	X	X	X	X	X	O	X	X	X	X	X	X	X	X	X	
0013	M	Parental Consent Forms	#	O	X	X	X	X	X	X	X	O	X	X	X	X	X	X	X	X	X	4
0014	M	Instruction Procedure, Submodule	#	O	O	O	X	X	O	X	X	O	X	X	X	X	X	X	O	X	X	
0015	M	Content Material, Submodule	#	O	O	O	X	O	O	X	O	O	O	X	O	O	X	O	O	X	O	
0019	E	Movie Projector, 8mm	#	O																		3
0020	P	Instructor, Classroom(I)	@	O	O	O	O	O	O	O	O											
0021	P	Instructor,Classroom(II)	@	O	O	O	O		O	O												
0022	E	Bimodal Simulator (BMS)	@		O	O	O		O	O												
0023	M	Maneuvers List,Submodule	* \#	O O	O O	O O			O O			X X	X X			X X			O O			

See page B-12 of specification for explanation of symbols.

Table 4-1: TRAINING AND TESTING MATERIALS, EQUIPMENT, FACILITIES AND STAFF for MODULE #4 , Collision Avoidance, Following Vehicle Threat

REQUIREMENT			USE	SUBMODULE																		NOTE
CODE		TITLE		A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	
0024	M	Maneuvers Description/ Illustration	*	O	O	O	X	X	O	X	X	O	O	X	X	O	X	X	O	X	X	
			#	O	X	X			X			X	X			X			O			
0025	M	Maneuvers Procedures	*	O	O	O			O			O	O			O			O			
			#	O	O	O			O			O	O	X		O	X		O	X		
0027	E	Screen, projection	#	O																		
0030	E	Projector, Movie, 16mm	@	O																		3
0032	M	Attendance Record	#	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	
0033	M	Student Performance Checklist	+			O	O		O	O			O	O		O	O			O		
			#					O			O				O			O			O	
0034	M	Video Tapes (Records)	#					O			O				O			O			O	
0035	P	Range Operations Coordinator	@									O	O	O		O	O			O		
0036	P	Instructor, Range (I)	@									O	O	O	O	O	O	O	O	O	O	
0037	P	Instructor, Range (II)	@									O	O	O		O	O			O		1
0038	F	Range, Auto Driving	@									O	O	O		O	O			O		
0039	E	Auto, Driver Training	@									O	O	O		O	O			O		1
0040	F	Classroom (I)	@	O																		2
0041	F	Classroom (II)	@		O	O	O	O	O	O	O				O			O	O		O	2
0042	E	Range marker cones	@									O	O	O		O	O			O		
0043	E	Range signal flags	@									O	O	O		O	O			O		
0044	M	Range marker stripes	@									O	O	O		O	O			O		
0045	E	Walkie-Talkies	@									O	O	O		O	O			O		
0046	E	Loudspeaker	@									O	O	O		O	O			O		
0047	E	First Aid Kit	@									X	X	X	X	X	X	X	X	X	X	
0048	E	Video Camera	+			O	O		O	O			O	O		O	O			O		
			@									O		O			O			O		

Table 4-1: TRAINING AND TESTING MATERIALS, EQUIPMENT, FACILITIES AND STAFF for MODULE # 4, Collision Avoidance, Following Vehicle Threat

REQUIREMENT			USE	SUBMODULE																		NOTE
CODE		TITLE		A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	
0049	E	Video Recorder/Player	+			O	O		O	O			O	O		O	O			O		
			@					O			O			O			O			O		
0050	E	Video Monitor (I)	+			O	O	X	O	O	X		O	O	X	O	O	X		O	X	
0051	E	Video Monitor II	@		O	O	O	O	O	O	O											
0052	E	Crash Helmets	*									O	O	O		O	O			O		
			#									O	O	O		O	O			O		
0053	M	Range Operations Checklist	@									O	O	O		O	O			O		
0054	P	Range Crew	@									O	O	O		O	O			O		
0055	E	Range Support Vehicle	@									O	O	O		O	O			O		
0056	M	Maneuver Sequence List	*	O																		
			#	O			O			O				O			O			O		
0061	M	Simulator Film	#		O	O	O		O	O												
0062	M	Conflict Situation Movie	#	O																		
0063	M	Conflict Presentation Schedule	#				O			O		X	O	O		O	O			O		
0064	M	Conflict Situation Diagrams	*	O	X	X		X	X		X	X			X			X			X	
			#	O	X	X	X	X	X	X	X	X			X			X			X	
0065	E	Surrogate Vehicle	@									O	O	O		O	O			O		1
0066	E	Controller, Surrogate Vehicle	@									O										
			#										O	O		O	O			O		1
0067	E	Emergency Equipment	@									X	X	X		X	X			X		

NOTES: (1) Two are required.

(2) Choice of classroom based on recommended class size.

(3) Choice of projector depends on type of movie film used.

(4) If appropriate.

(1) MODULE NO: 4	(2) MODULE TITLE: Collision Avoidance: Avoid being struck by following vehicle.

Table 4-2: Obstruction variables and best chance avoidance maneuvers for following vehicle threat conflict

CONFLICT VARIABLES	KEY	MANEUVER ALTERNATIVES BY OBSTRUCTION VARIABLES			
		NO OBSTRUCTIONS	LEFT LANE OBSTRUCTED	RIGHT LANE OBSTRUCTED	LEFT AND RIGHT LANES OBSTRUCTED
Following vehicle closing; subject's vehicle will be struck at left-rear quarter (Condition #1).	BEST CHANCE MANEUVER	Accelerate and steer right	Accelerate and steer right	Accelerate and steer left	Accelerate straight ahead
	RESULTANT	Avoidance	Avoidance	Avoidance (1)	Severity reduction
	ILLUSTRATION	FIG. 4.1	FIG. 4.3	FIG. 4.5	FIG. 4.7
Following vehicle closing; subject's vehicle will be struck at right-rear quarter (Condition #2).	BEST CHANCE MANEUVER	Accelerate and steer left	Accelerate and steer right	Accelerate and steer left	Accelerate straight ahead
	RESULTANT	Avoidance	Avoidance (1)	Avoidance	Severity reduction
	ILLUSTRATION	FIG. 4.2	FIG. 4.4	FIG. 4.6	FIG. 4.8
	BEST CHANCE MANEUVER				
	RESULTANT				
	ILLUSTRATION	FIG.	FIG.	FIG.	FIG.
	BEST CHANCE MANEUVER				
	RESULTANT				
	ILLUSTRATION	FIG.	FIG.	FIG.	FIG.

NOTES: (1) Less likely to achieve complete avoidance due to necessity of crossing path of CV.

(2) All potentially successful avoidance maneuvers require some SV forward motion; if both SV and are stopped, no maneuver alternatives are available.

(3) If SV and obstruction (e.g., a lead vehicle) are moving at the same velocity.

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R ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

ision Avoidance: Avoid being struck by following vehicle.

t chance avoidance maneuvers for following vehicle threat conflict.

MANEUVER ALTERNATIVES BY OBSTRUCTION VARIABLES				
NO OBSTRUCTIONS	LEFT LANE OBSTRUCTED	RIGHT LANE OBSTRUCTED	LEFT AND RIGHT LANES OBSTRUCTED	STRAIGHT AHEAD OBSTRUCTED
Accelerate and steer right	Accelerate and steer right	Accelerate and steer left	Accelerate straight ahead	None(2), or steer right(3)
Avoidance	Avoidance	Avoidance(1)	Severity reduction	Collision, or sever. reduct(3)
FIG. 4.1	FIG. 4.3	FIG. 4.5	FIG. 4.7	FIG. (TBD)
Accelerate and steer left	Accelerate and steer right	Accelerate and steer left	Accelerate straight ahead	None(2), or steer left(3)
Avoidance	Avoidance(1)	Avoidance	Severity reduction	Collision or sever. reduct.(3)
FIG. 4.2	FIG. 4.4	FIG. 4.6	FIG. 4.8	FIG. (TBD)
FIG.	FIG.	FIG.	FIG.	FIG.
FIG.	FIG.	FIG.	FIG.	FIG.

te avoidance due to necessity of crossing path of CV.

oidance maneuvers require some SV forward motion; if both SV and obstruction
a lead vehicle) are moving at the same velocity.

rnatives are available.

epared : G. R. Hatterick	Approved By:	Page 4-25

B-115

MODULE NO: 5

COLLISION AVOIDANCE

AVOID STRIKING LEAD VEHICLE

(Lead Vehicle Obstacle)

SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

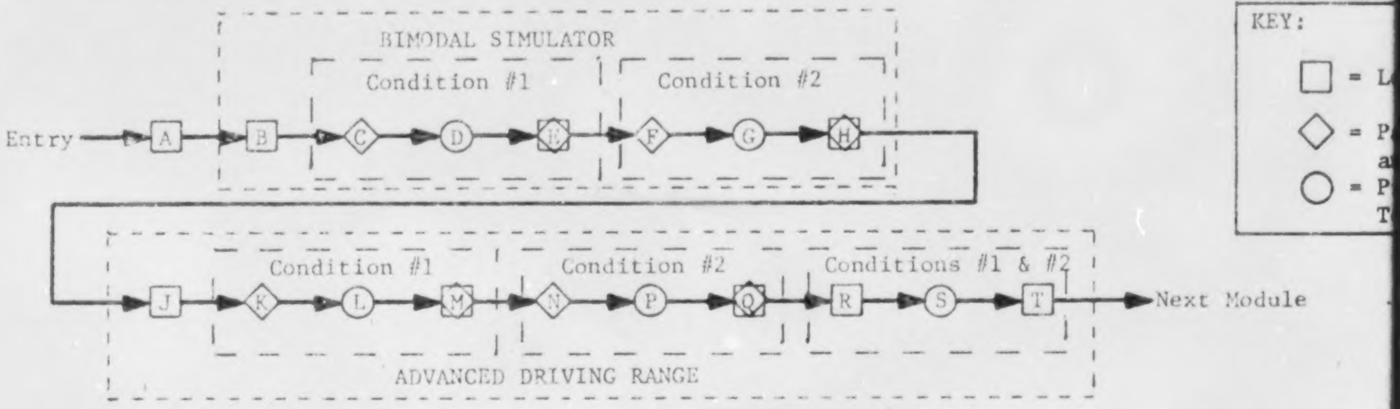
(1) MODULE No: 5	(2) MODULE TITLE: Collision Avoidance; Avoid striking lead vehicle.

(3) PURPOSE OF MODULE: To provide students with the perceptual skills to recognize this type of conflict maneuvering skills to successfully avoid, or reduce the effects of, a collision.

(4) STUDENT ENTRANCE PREREQUISITES: Completion of Module #1; A valid automobile operator's license.

(5) APPLICABLE INSTRUCTION TECHNIQUES: Classroom lecture; Bimodal simulator; Advanced driving range.

(6) INSTRUCTIONAL APPROACH: Instruction will be given in a series of submodules:



A: Lecture- Lead vehicle obstacle
B: Bimodal Simulator Demonstration
C: Simulator Practice, Condition #1
D: Simulator Test, Condition #1
E: Simulator Test Debriefing, Condition #1
F: Simulator Practice, Condition #2
G: Simulator Test, Condition #2
H: Simulator Test Debriefing, Condition #2
J: Advanced Driving Range Demonstration
K: Advanced Range Practice, Condition #1
L: Advanced Range Test, Condition #1
M: Advanced Range Test Debriefing, Condition #1
N: Advanced Range Practice, Condition #2
P: Advanced Range Test, Condition #2
Q: Advanced Range Test Debriefing, Condition #2
R: Pre-test Briefing, Advanced Range, Integrated
S: Advanced Range Test, Integrated Conditions #1
T: Advanced Range Test Debriefing, Integrated Con

CONDITIONS:

#1 - Subject's vehicle will strike lead vehicle
quarter if not successfully avoided.

#2 - Subject's vehicle will strike lead vehicle
quarter if not successfully avoided.

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PF-0530-1/1

R ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

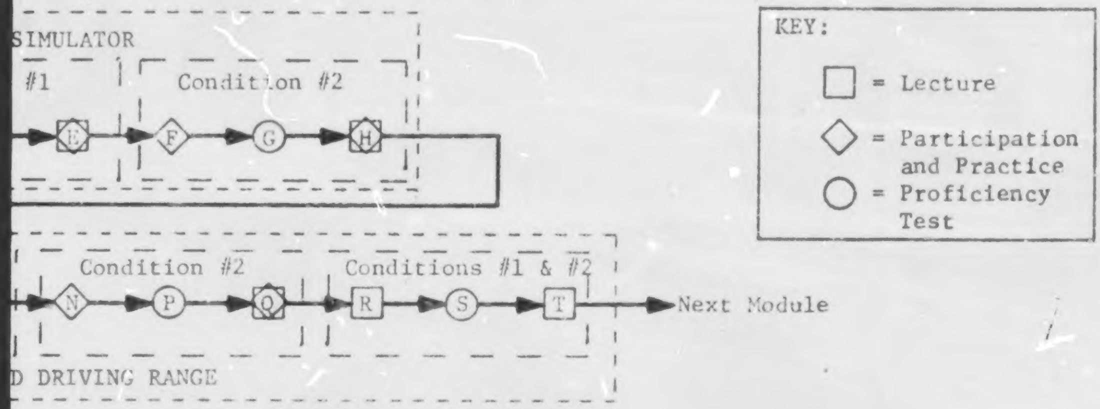
llision Avoidance; Avoid striking lead vehicle.

ents with the perceptual skills to recognize this type of conflict, and the lls to successfully avoid, or reduce the effects of, a collision.

mpletion of Module #1; A valid automobile operator's license.

Classroom lecture, Bimodal simulator; Advanced driving range.

n will be given in a series of submodules:


SIMULATOR
#1
Condition #2
E
F
G
H
KEY:
□ = Lecture
◇ = Participation and Practice
○ = Proficiency Test
Condition #2
Conditions #1 & #2
N
P
Q
R
S
T
Next Module
D DRIVING RANGE

M: Advanced Range Test Debriefing, Condition #1
N: Advanced Range Practice, Condition #2
P: Advanced Range Test, Condition #2
Q: Advanced Range Test Debriefing, Condition #2
ion #1
R: Pre-test Briefing, Advanced Range, Integrated Conditions
S: Advanced Range Test, Integrated Conditions #1 and #2.
T: Advanced Range Test Debriefing, Integrated Conditions #1 & 2
ion #2
ion
n #1

CONDITIONS:

#1 - Subject's vehicle will strike lead vehicle at left rear quarter if not successfully avoided.

#2 - Subject's vehicle will strike lead vehicle at right rear quarter if not successfully avoided.

repared y: G. R. Hatterick	Approved By:	Page 5-1

SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 5

② MODULE TITLE: Collision Avoidance; Avoid striking lead vehicle.

⑦ SUBMODULE NO: 5.A.

⑧ SUBMODULE TITLE: Lecture - Lead vehicle obstacle.

⑨ SUBMODULE OBJECTIVES:

(1) To develop in the student a cognizance of the characteristics of the onset conditions and potentially successful response maneuvers for the following conflict situations:

  (a) Subject's vehicle closing on lead vehicle; will strike left rear quarter of lead vehicle (figure 5.1).
  (b) Subject's vehicle closing on lead vehicle; will strike right rear quarter of lead vehicle (figure 5.2).

(2) To develop in the student a visual image of the characteristics of the onset conditions, multi-vehicle dynamics, and response maneuvers for the above conflict situations.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will
following obstruction variables: *

  (a) No obstructions;
  (b) Left lane obstructed;
  (c) Right lane obstructed:
  (d) Left lane and right lane obstruct

*Obstruction variables are illustrated in
through 5.8

⑪ STUDENT MATERIALS: See Table 5-1

⑫ INSTRUCTOR MATERIALS: See Table 5-1

⑬ EVALUATION MATERIALS: See Table 5-1

⑭ SUPPORT
See Tab

Issue Date: 12/29/75

Revision No: 2

Prepared By: G. R. Hatterick

Approved By:

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PF-05.0-1/2 (a)

ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will include the following obstruction variables: *

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed:
(d) Left lane and right lane obstructed.

*Obstruction variables are illustrated in Figures 5.1 through 5.8

R MATERIALS: 5-1	⑬ EVALUATION MATERIALS: See Table 5-1	⑭ SUPPORT REQUIREMENTS: See Table 5-1

d G. R. Hatterick	Approved By:	Page 5-2

① MODULE NO: 5	② MODULE TITLE: Collision Avoidance; Avoid striking lead vehicle.
⑦ SUBMODULE NO: 5.B.	⑧ SUBMODULE TITLE: Bimodal Simulator Demonstration; Lead vehicle obstacle.

⑨ SUBMODULE OBJECTIVES:

(1) To familiarize the student with the characteristics of the onset conditions and potentially successful response maneuvers, as they will appear in simulation, for the following conflict situations:

- (a) Subject's vehicle closing on lead vehicle; will strike left rear quarter of lead vehicle (figure 5.1).
- (b) Subject's vehicle closing on lead vehicle; will strike right rear quarter of lead vehicle (figure 5.2).

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations wil
following obstruction variables: *

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lane obstructed;
- (d) Left and right lane obstructed.

*Obstruction variables are illustrated in
through 5.8

⑪ STUDENT MATERIALS:	⑫ INSTRUCTOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPORT
See Table 5-1	See Table 5-1	See Table 5-1	See Tab

Issue Date: 12/29/75	Revision No: 2	Prepared By: G. R. Hatterick	Approved By:	P

CCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

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al Simulator Demonstration; Lead vehicle obstacle.

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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will include the following obstruction variables: *

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lane obstructed;
- (d) Left and right lane obstructed.

*Obstruction variables are illustrated in Figures 5.1 through 5.8

R MATERIALS: 5-1	⑬ EVALUATION MATERIALS: See Table 5-1	⑭. SUPPORT REQUIREMENTS: See Table 5-1

ed G. R. Hatterick	Approved By:	Page 5-3

① MODULE NO: 5

② MODULE TITLE: Collision Avoidance; Avoid striking lead vehicle.

⑦ SUBMODULE NO: 5.C.

⑧ SUBMODULE TITLE: Bimodal Simulator Practice: Subject's vehicle will strike left of lead car (Condition #1).

⑨ SUBMODULE OBJECTIVES:

(1) Train student drivers to recognize the onset of this conflict situation at the earliest possible moment:

  (a) Subject's vehicle closing on lead vehicle: will strike left rear quarter of lead vehicle (figure 5.1).

(2) Train student drivers to instantaneously select, from the available choices, the alternative which will most likely avoid, or minimize the effects of a collision:(See Table 5-2)

(3) Train student drivers to effectively implement the alternative selected through evasive maneuvering of their vehicle.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations wil following obstruction variables: *

  (a) No obstructions;
  (b) Left lane obstructed;
  (c) Right lane obstructed;
  (d) Left and right lane obstructed.

*Obstruction variables are illustrated in through 5.8

⑪ STUDENT MATERIALS:	⑫ INSTRUCTOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPORT
See Table 5-1	See Table 5-1	See Table 5-1	See Tab

Issue Date: 12/29/75	Revision No: 2	Prepared By: G. K. Hatterick	Approved By:	Pa

PF-0580-1/2 (a)

OR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

lision Avoidance; Avoid striking lead vehicle.

Bimodal Simulator Practice: Subject's vehicle will strike left rear quarter of lead car (Condition #1).

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possible moment:

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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will include the following obstruction variables: *

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left and right lane obstructed.

*Obstruction variables are illustrated in Figures 5.1 through 5.8

CTOR MATERIALS:

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⑬ EVALUATION MATERIALS:

See Table 5-1

⑭ SUPPORT REQUIREMENTS:

See Table 5-1

ared
G. R. Hatterick

Approved
By:

Page 5-4

SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 5

② MODULE TITLE: Collision Avoidance; Avoid striking lead vehicle.

⑦ SUBMODULE NO: 5.D.

⑧ SUBMODULE TITLE: Bimodal Simulator Test; Subject's vehicle will strike left rear
lead vehicle (Condition #1).

⑨ SUBMODULE OBJECTIVES:

(1) To ascertain that each student has learned to recognize the precursor conditions of this conflict situation as soon as they appear:

(a) Subject's vehicle closing on lead vehicle; will strike left rear quarter of lead vehicle (figure 5.1).

(2) To determine that the student has learned to select the most feasible alternative available to either avoid, or reduce the effects of, a collision resulting from this conflict;

(3) To determine that the student has learned to effectively implement the avoidance maneuver selected in this conflict situation.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will
following obstruction variables: *

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lane obstructed;
- (d) Left and right lane obstructed.

*Obstruction variables are illustrated in
through 5.8

⑪ STUDENT MATERIALS: See Table 5-1

⑫ INSTRUCTOR MATERIALS: See Table 5-1

⑬ EVALUATION MATERIALS: See Table 5-1

⑭ SUPPORT
See Tab

Issue Date: 12/29/75	Revision No: 2	Prepared By: G. R. Hatterick	Approved By:	P

PF-0535-1/2 (a)

ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

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imodal Simulator Test; Subject's vehicle will strike left rear quarter of
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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will include the following obstruction variables: *

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lane obstructed;
- (d) Left and right lane obstructed.

*Obstruction variables are illustrated in Figures 5.1 through 5.8

CTOR MATERIALS: ble 5-1	⑬ EVALUATION MATERIALS: See Table 5-1	⑭ SUPPORT REQUIREMENTS: See Table 5-1

ared G. R. Hatterick	Approved By:	Page 5-5

SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 5

② MODULE TITLE: Collision Avoidance; Avoid striking lead vehicle.

⑦ SUBMODULE NO: 5.E.

⑧ SUBMODULE TITLE: Bimodal Simulator Test Debriefing: Subject's vehicle will impact
of lead vehicle (Condition #1).

⑨ SUBMODULE OBJECTIVES:

(1) To provide to the student an immediate assessment of the level of performance achieved during the test for the following conflict situation.

(a) Subject's vehicle closing on lead vehicle; will strike left rear quarter of lead vehicle (figure 5.1).

(2) To provide to the student specific comments regarding deficiencies in performance and the corrective action required, and instances of superior performance.

(3) To gain from the student an immediate appraisal of difficulties encountered and reactions to the test.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations wil
following obstruction variables: *

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left and right lane obstructed.

*Obstruction variables are illustrated in
through 5.8

⑪ STUDENT MATERIALS: See Table 5-1

⑫ INSTRUCTOR MATERIALS: See Table 5-1

⑬ EVALUATION MATERIALS: See Table 5-1

⑭ SUPPORT
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Revision No: 2
Prepared By: G. R. Hatterick
Approved By:
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PF-0530-1/2 (a)

FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

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Bimodal Simulator Test Debriefing: Subject's vehicle will impact left rear quarter of lead vehicle (Condition #1).

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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will include the following obstruction variables: *

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left and right lane obstructed.

*Obstruction variables are illustrated in Figures 5.1 through 5.8

UCTOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPORT REQUIREMENTS:
able 5-1	See Table 5-1	See Table 5-1

pared G. R. Hatterick	Approved By:	Page 5-6

SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 5	② MODULE TITLE: Collision Avoidance; Avoid striking lead vehicle.
⑦ SUBMODULE NO: 5.F.	⑧ SUBMODULE TITLE: Bimodal Simulator Practice: Subject's vehicle will strike right of lead car (Condition #2).

⑨ SUBMODULE OBJECTIVES:

(1) Train student drivers to recognize the onset of this conflict situation at the earliest possible moment:

(a) Subject's vehicle closing on lead vehicle; will strike right rear quarter of lead vehicle (figure 5.2).

(2) Train student drivers to instantaneously select, from the available choices, the alternative which will most likely avoid, or minimize the effects of a collision; (See Table 5-2);

(3) Train student drivers to effectively implement the alternative selected through evasive maneuvering of their vehicle.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations wil
following obstruction variables: *

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left and right lane obstructed.

*Obstruction variables are illustrated in
through 5.8

⑪ STUDENT MATERIALS:	⑫ INSTRUCTOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPORT
See Table 5-1	See Table 5-1	See Table 5-1	See Tab

Issue Date: 12/29/75	Revision No: 2	Prepared By: G. R. Hatterick	Approved By:

OR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

lision Avoidance; Avoid striking lead vehicle.

Bimodal Simulator Practice: Subject's vehicle will strike right rear quarter of lead car (Condition #2).

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possible moment:

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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will include the following obstruction variables:*

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left and right lane obstructed.

*Obstruction variables are illustrated in Figures 5.1 through 5.8

RUCTOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPORT REQUIREMENTS:
Table 5-1	See Table 5-1	See Table 5-1

epared : G. R. Hatterick	Approved By:	Page 5-7

① MODULE NO: 5	② MODULE TITLE: Collision Avoidance; Avoid striking lead vehicle.
⑦ SUBMODULE NO: 5.G.	⑧ SUBMODULE TITLE: Bimodal Simulator Test; Subject's vehicle will strike right re lead car (Condition #2).

⑨ SUBMODULE OBJECTIVES:

(1) To ascertain that each student has learned to recognize the precursor conditions of these conflict situations as soon as they appear;

(a) Subject's vehicle closing on lead vehicle; will strike right rear quarter of lead vehicle (figure 5.2).

(2) To determine that the student has learned to select the most feasible alternative available to either avoid, or reduce the effects of, a collision resulting from this conflict;

(3) To determine that the student has learned to effectively implement the avoidance maneuver selected in this conflict situation.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations wi
following obstruction variables: *

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left and right lane obstructed

*Obstruction variables are illustrated i
through 5.8

⑪ STUDENT MATERIALS: See Table 5-1	⑫ INSTRUCTOR MATERIALS: See Table 5-1	⑬ EVALUATION MATERIALS: See Table 5-1	⑭ SUPPOR See Ta

Issue Date: 12/29/75	Revision No: 2	Prepared By: G. R. Hatterick	Approved By:

PF-0500-1/2 (a)

FICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

ITLE: Collision Avoidance; Avoid striking lead vehicle.

TITLE: Bimodal Simulator Test; Subject's vehicle will strike right rear quarter of lead car (Condition #2).

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situation.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will include the following obstruction variables: *

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left and right lane obstructed.

*Obstruction variables are illustrated in Figures 5.1 through 5.8

2 INSTRUCTOR MATERIALS:

See Table 5-1

⑬ EVALUATION MATERIALS:

See Table 5-1

⑭ SUPPORT REQUIREMENTS:

See Table 5-1

Prepared By: G. R. Hatterick

Approved By:

Page 5-8

① MODULE NO: 5

② MODULE TITLE: Collision Avoidance; Avoid striking lead vehicle.

⑦ SUBMODULE NO: 5.H.

⑧ SUBMODULE TITLE: Bimodal Simulator Test Debriefing; Subject's vehicle will impac quarter of lead vehicle (Condition #2).

⑨ SUBMODULE OBJECTIVES:

(1) To provide to the student an immediate assessment of the level of performance achieved during the test for the following conflict situation:

   (a) Subject's vehicle closing on lead vehicle; will strike right rear quarter of lead vehicle (figure 5.2).

(2) To provide to the student specific comments regarding deficiencies in performance and the corrective action required, and instances of superior performance.

(3) To gain from the student an immediate appraisal of difficulties encountered and reactions to the test.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations wi following obstruction variables: *

   (a) No obstructions;
   (b) Left lane obstructed;
   (c) Right lane obstructed;
   (d) Left and right lane obstructed

*Obstruction variables are illustrated i through 5.8

⑪ STUDENT MATERIALS:	⑫ INSTRUCTOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPOR
See Table 5-1	See Table 5-1	See Table 5-1	See T

Issue Date: 12/29/75	Revision No: 2	Prepared By: G. R. Hatterick	Approved By:

PF-0530-1/2 (a)

ION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

Collision Avoidance; Avoid striking lead vehicle.

LE: Bimodal Simulator Test Debriefing; Subject's vehicle will impact right rear quarter of lead vehicle (Condition #2).

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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will include the following obstruction variables: *

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lane obstructed;
- (d) Left and right lane obstructed.

*Obstruction variables are illustrated in Figures 5.1 through 5.8

NSTRUCTOR MATERIALS: ee Table 5-1	⑬ EVALUATION MATERIALS: See Table 5-1	⑭ SUPPORT REQUIREMENTS: See Table 5-1

Prepared By: G. R. Hatterick	Approved By:	Page 5-9

① MODULE NO: 5	② MODULE TITLE: Collision Avoidance; Avoid striking lead vehicle.
⑦ SUBMODULE NO: 5.J.	⑧ SUBMODULE TITLE: Advanced Driving Range Demonstration; Lead vehicle obstacle.

⑨ SUBMODULE OBJECTIVES:

(1) To familiarize the student with the characteristics of the onset conditions and potentially successful response maneuvers, as they will appear on the driving range, for the following conflict situations:

(a) Subject's vehicle closing on lead vehicle; will strike left rear quarter of lead vehicle (figure 5.1).

(b) Subject's vehicle closing on lead vehicle; will strike right rear quarter of lead vehicle (figure 5.2).

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will i
following obstruction variables: *

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left land and right lane obstructe

(2) Only student participants and required
staff will be permitted on the range d
submodule.

(3) All range safety equipment and procedu
verified prior to initiating demonstra
student practice sessions.

(4) Range Safety Monitor must be on duty a
during the use of the range.

*Obstruction variables are illustrated in
through 5.8

⑪ STUDENT MATERIALS: See Table 5-1	⑫ INSTRUCTOR MATERIALS: See Table 5-1	⑬ EVALUATION MATERIALS: See Table 5-1	⑭ SUPPORT See Table

Issue Date: 12/29/75	Revision No: 2	Prepared By: G. R. Hatterick	Approved By:	Pa

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N FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

Collision Avoidance; Avoid striking lead vehicle.

: Advanced Driving Range Demonstration; Lead vehicle obstacle.

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appear on the
conflict situations:

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lead vehicle

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will include the following obstruction variables: *

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left land and right lane obstructed.

(2) Only student participants and required instructor staff will be permitted on the range during this submodule.

(3) All range safety equipment and procedures will be verified prior to initiating demonstration and/or student practice sessions.

(4) Range Safety Monitor must be on duty at all times during the use of the range.

*Obstruction variables are illustrated in Figures 5.1 through 5.8

TRUCTOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPORT REQUIREMENTS:
e Table 5-1	See Table 5-1	See Table 5-1

repared y: G. R. Hatterick	Approved By:	Page 5-10

SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 5	② MODULE TITLE: Collision Avoidance; Avoid striking lead vehicle.
⑦ SUBMODULE NO: 5.K.	⑧ SUBMODULE TITLE: Advanced Driving Range Practice; Subject's vehicle will strike of lead car (Condition #1).

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⑨ SUBMODULE OBJECTIVES:

(1) Train student drivers to recognize the onset of this conflict situation at the earliest possible moment:

(a) Subject's vehicle closing on lead vehicle; will strike left rear quarter of lead vehicle (figure 5.1).

(2) Train student drivers to instantaneously select, from the available choices, the alternative which will most likely avoid, or minimize the effects of a collision: (See Table 5-2)

(3) Train student drivers to effectively implement the alternative selected through evasive maneuvering of their vehicle.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Only student participants and requi
staff will be permitted on the range
submodule.

(2) All range safety equipment and proc
verified prior to initiating studen
sessions.

(3) Range Safety Monitor must be on dut
during the use of the range.

(4) Each of the conflict situations wil
following obstruction variables: *

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed:
(d) Left lane and right lane obstru

*Obstruction variables are illustrated i
through 5.8

⑪ STUDENT MATERIALS: See Table 5-1	⑫ INSTRUCTOR MATERIALS: See Table 5-1	⑬ EVALUATION MATERIALS: See Table 5-1	⑭ SUPPOR See Tab

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FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

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Advanced Driving Range Practice; Subject's vehicle will strike left rear quarter of lead car (Condition #1).

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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Only student participants and required instructor staff will be permitted on the range during this submodule.

(2) All range safety equipment and procedures will be verified prior to initiating student practice sessions.

(3) Range Safety Monitor must be on duty at all times during the use of the range.

(4) Each of the conflict situations will include the following obstruction variables: *

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed:
(d) Left lane and right lane obstructed.

*Obstruction variables are illustrated in Figures 5.1 through 5.8

STRUCTOR MATERIALS: e Table 5-1	⑬ EVALUATION MATERIALS: See Table 5-1	⑭ SUPPORT REQUIREMENTS: See Table 5-1

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① MODULE NO: 5

② MODULE TITLE: Collision Avoidance Test; Avoid striking lead vehicle.

⑦ SUBMODULE NO: 5.L.

⑧ SUBMODULE TITLE: Advanced Driving Range Test; Subject's vehicle will strike left re
lead car (Condition #1).

⑨ SUBMODULE OBJECTIVES:

(1) To ascertain that each student has learned to recognize the precursor conditions of this conflict situation as soon as they appear:

  (a) Subject's vehicle closing on lead vehicle; will strike left rear quarter of lead vehicle (figure 5.1).

(2) To determine that the student has learned to select the most feasible alternative available to either avoid, or reduce the effects of, a collision resulting from this conflict;

(3) To determine that the student has learned to effectively implement the avoidance maneuver selected in this conflict situations.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Only student participants and required
staff will be permitted on the range d
submodule.

(2) All range safety equipment and procedu
verified prior to initiating student t

(3) Range Safety Monitor must be on duty a
during the use of the range.

(4) Each of the conflict situations will f
following obstruction variables: *

  (a) No obstructions;
  (b) Left lane obstructed;
  (c) Right lane obstructed;
  (d) Left lane and right lane obstructe

*Obstruction variables are illustrated in F
through 5.8

⑪ STUDENT MATERIALS: See Table 5-1

⑫ INSTRUCTOR MATERIALS: See Table 5-1

⑬ EVALUATION MATERIALS: See Table 5-1

⑭ SUPPORT R

See Table

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Prepared By: G. R. Hatterick

Approved By:

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FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

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Advanced Driving Range Test; Subject's vehicle will strike left rear quarter of lead car (Condition #1).

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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Only student participants and required instructor staff will be permitted on the range during this submodule.

(2) All range safety equipment and procedures will be verified prior to initiating student test sessions.

(3) Range Safety Monitor must be on duty at all times during the use of the range.

(4) Each of the conflict situations will include the following obstruction variables: *

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lane obstructed;
- (d) Left lane and right lane obstructed.

*Obstruction variables are illustrated in Figures 5.1 through 5.8

RUCTOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPORT REQUIREMENTS:
Table 5-1	See Table 5-1	See Table 5-1

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SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 5	② MODULE TITLE: Collision Avoidance; Avoid striking lead vehicle.
⑦ SUBMODULE NO: 5.M.	⑧ SUBMODULE TITLE: Advanced Driving Range Test Debriefing; Subject's vehicle will quarter of lead vehicle (Condition #1).

⑨ SUBMODULE OBJECTIVES:

(1) To provide to the student an immediate assessment of the level of performance achieved during the test, for the following conflict situation:

- (a) Subject's vehicle closing on lead vehicle; will strike left rear quarter of lead vehicle (figure 5.1).

(2) To provide to the student specific comments regarding deficiencies in performance and the corrective action required, and instances of superior performance.

(3) To gain from the student an immediate appraisal of difficulties encountered and reactions to the test.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will
following obstruction variables: *

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lane obstructed;
- (d) Left lane and right lane obstruct

*Obstruction variables are illustrated in
through 5.8

⑪ STUDENT MATERIALS: See Table 5-1	⑫ INSTRUCTOR MATERIALS: See Table 5-1	⑬ EVALUATION MATERIALS: See Table 5-1	⑭ SUPPORT See Tab

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OR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

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Advanced Driving Range Test Debriefing; Subject's vehicle will impact left rear quarter of lead vehicle (Condition #1).

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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will include the following obstruction variables: *

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left lane and right lane obstructed.

*Obstruction variables are illustrated in Figures 5.1 through 5.8

RUCTOR MATERIALS: Table 5-1	⑬ EVALUATION MATERIALS: See Table 5-1	⑭ SUPPORT REQUIREMENTS: See Table 5-1

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① MODULE NO:
5

② MODULE TITLE: Collision Avoidance: Avoid striking lead vehicle.

⑦ SUBMODULE NO:
5.N.

⑧ SUBMODULE TITLE: Advanced Driving Range Practice; Subject's vehicle will strike
quarter of lead car (Condition #2).

⑨ SUBMODULE OBJECTIVES:

(1) Train student drivers to recognize the onset of this conflict situation at the earliest possible moment:

  (a) Subject's vehicle closing on lead vehicle; will strike right rear quarter of lead vehicle (figure 5.2).

(2) Train student drivers to instantaneously select, from the available choices, the alternative which will most likely avoid, or minimize the effects of a collision; (See Table 5-2)

(3) Train student drivers to effectively implement the alternative selected through evasive maneuvering of their vehicle.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Only student participants and require
staff will be permitted on the range
submodule.

(2) All range safety equipment and proced
verified prior to initiating student
sessions.

(3) Range Safety Monitor must be on duty
during the use of the range.

(4) Each of the conflict situations will
following obstruction variables: *

  (a) No obstructions;
  (b) Left lane obstructed;
  (c) Right lane obstructed;
  (d) Left lane and right lane obstruct

*Obstruction variables are illustrated in
through 5.8

⑪ STUDENT MATERIALS:

See Table 5-1

⑫ INSTRUCTOR MATERIALS:

See Table 5-1

⑬ EVALUATION MATERIALS:

See Table 5-1

⑭ SUPPORT

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Advanced Driving Range Practice; Subject's vehicle will strike right rear quarter of lead car (Condition #2).

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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Only student participants and required instructor staff will be permitted on the range during this submodule.

(2) All range safety equipment and procedures will be verified prior to initiating student practice sessions.

(3) Range Safety Monitor must be on duty at all times during the use of the range.

(4) Each of the conflict situations will include the following obstruction variables: *

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lane obstructed;
- (d) Left lane and right lane obstructed.

*Obstruction variables are illustrated in Figures 5.1 through 5.8

CTOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPORT REQUIREMENTS:
ble 5-1	See Table 5-1	See Table 5-1

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SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 5	② MODULE TITLE: Collision Avoidance; Avoid striking lead vehicle.
⑦ SUBMODULE NO: 5.P.	⑧ SUBMODULE TITLE: Advanced Driving Range Test; Subject's vehicle will strike right of lead car (Condition #2).

⑨ SUBMODULE OBJECTIVES:

(1) To ascertain that each student has learned to recognize the precursor conditions of this conflict situation as soon as they appear:

  (a) Subject's vehicle closing on lead vehicle; will strike right rear quarter of lead vehicle (figure 5.2).

(2) To determine that the student has learned to select the most feasible alternative available to either avoid, or reduce the effects of, a collision resulting from this conflict;

(3) To determine that the student has learned to effectively implement the avoidance maneuver selected in this conflict situation.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Only student participants and required
staff will be permitted on the range d
submodule.

(2) All range safety equipment and procedu
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(3) Range Safety Monitor must be on duty a
during the use of the range.

(4) Each of the conflict situations will i
following obstruction variables:*

  (a) No obstructions;
  (b) Left lane obstructed;
  (c) Right lane obstructed;
  (d) Left lane and right lane obstructe

*Obstruction variables are illustrated in Fi
through 5.8

⑪ STUDENT MATERIALS:	⑫ INSTRUCTOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPORT RE
See Table 5-1	See Table 5-1	See Table 5-1	See Table

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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Only student participants and required instructor staff will be permitted on the range during this submodule.

(2) All range safety equipment and procedures will be verified prior to initiating student test sessions.

(3) Range Safety Monitor must be on duty at all times during the use of the range.

(4) Each of the conflict situations will include the following obstruction variables:*

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left lane and right lane obstructed.

*Obstruction variables are illustrated in Figures 5.1 through 5.8

CTOR MATERIALS: ble 5-1	⑬ EVALUATION MATERIALS: See Table 5-1	⑭ SUPPORT REQUIREMENTS: See Table 5-1

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① MODULE NO: 5

② MODULE TITLE: Collision Avoidance; Avoid striking lead vehicle.

⑦ SUBMODULE NO: 5.Q.

⑧ SUBMODULE TITLE: Advanced Driving Range Test Debriefing; Subject's vehicle will
rear quarter of lead vehicle (Condition #2).

⑨ SUBMODULE OBJECTIVES:

(1) To provide to the student an immediate assessment of the level of performance achieved during the test, for the following conflict:

(a) Subject's vehicle closing on lead vehicle; will strike right rear quarter of lead vehicle (figure 5.2).

(2) To provide to the student specific comments regarding deficiencies in performance and the corrective action required, and instances of superior performance;

(3) To gain from the student an immediate appraisal of difficulties encountered and reactions to the test.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations wi
following obstruction variables:

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lane obstructed;
- (d) Left and right lane obstructe

*Obstruction variables are illustrated i
through 5.8

⑪ STUDENT MATERIALS: See Table 5-1

⑫ INSTRUCTOR MATERIALS: See Table 5-1

⑬ EVALUATION MATERIALS: See Table 5-1

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Advanced Driving Range Test Debriefing; Subject's vehicle will impact right rear quarter of lead vehicle (Condition #2).

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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will include the following obstruction variables: *

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lane obstructed;
- (d) Left and right lane obstructed.

*Obstruction variables are illustrated in Figures 5.1 through 5.8

UCTOR MATERIALS:

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⑬ EVALUATION MATERIALS:

See Table 5-1

⑭ SUPPORT REQUIREMENTS:

See Table 5-1

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By:

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SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 5	② MODULE TITLE: Collision Avoidance; Avoid striking lead vehicle.
⑦ SUBMODULE NO: 5.R.	⑧ SUBMODULE TITLE: Pre-Test Briefing, Advanced Driving Range Test; Subject's veh either the left rear (Condition #1) or right rear (Condition

⑨ SUBMODULE OBJECTIVES:

(1) To prepare the student for conduct of the integrated testing submodule by describing the scope of the test, reviewing the characteristics of the included conflict situations, and describing the maneuvers most likely to be successful for the following conflict situations:

(a) Subject's vehicle closing on lead vehicle; will strike left rear quarter of lead vehicle (figure 5.1).

(b) Subject's vehicle closing on lead vehicle; will strike right rear quarter of lead vehicle (figure 5.2).

(2) To assure that the student comprehends the need to select the most appropriate course of evasive action based on the specific characteristics of the conflict situations confronting him.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations w
following obstruction variables: *

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left and right lane obstructe

*Obstruction variables are illustrated i
through 5.8

⑪ STUDENT MATERIALS:	⑫ INSTRUCTOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPOR
See Table 5-1	See Table 5-1	See Table 5-1	See T

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FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

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Pre-Test Briefing, Advanced Driving Range Test; Subject's vehicle may strike either the left rear (Condition #1) or right rear (Condition #2) of the lead ca

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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will include the following obstruction variables: *

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lane obstructed;
- (d) Left and right lane obstructed.

*Obstruction variables are illustrated in Figures 5.1 through 5.8

RUCTOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPORT REQUIREMENTS:
Table 5-1	See Table 5-1	See Table 5-1

epared : G. R. Hatterick	Approved By:	

① MODULE NO: 5

② MODULE TITLE: Collision Avoidance; Avoid striking lead vehicle.

⑦ SUBMODULE NO: 5.S.

⑧ SUBMODULE TITLE: Integrated Advanced Range Test; Subject's vehicle may strike eith
rear (Condition #1) of the right rear (Condition #2) of the lead car.

⑨ SUBMODULE OBJECTIVES:

(1) To ascertain that each student has learned to recognize the precursor conditions of these conflict situations as soon as they appear:

- (a) Subject's vehicle closing on lead vehicle; will strike left rear quarter of lead vehicle (figure 5.1).
- (b) Subject's vehicle closing on lead vehicle; will strike right rear quarter of lead vehicle (figure 5.2).

(2) To determine that the student has learned to select the most feasible alternative available to either avoid, or reduce the effects of, a collision resulting from this conflict;

(3) To determine that the student has learned to effectively implement the avoidance maneuver selected in this conflict situation.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Only student participants and [illegible]ired
staff will be permitted on the [illegible]
submodule.

(2) All range safety equipment and procedu
verified prior to initiating student

(3) Range Safety Monitor must be on duty
during the use of the range.

(4) Each of the conflict situations will
following obstruction variables:*

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lane obstructed;
- (d) Left land and right lane obstructe

*Obstruction variables are illustrated in F
through 5.8

⑪ STUDENT MATERIALS: See Table 5-1

⑫ INSTRUCTOR MATERIALS: See Table 5-1

⑬ EVALUATION MATERIALS: See Table 5-1

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ON FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

Collision Avoidance; Avoid striking lead vehicle.

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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Only student participants and required instructor staff will be permitted on the range during this submodule.

(2) All range safety equipment and procedures will be verified prior to initiating student test sessions.

(3) Range Safety Monitor must be on duty at all times during the use of the range.

(4) Each of the conflict situations will include the following obstruction variables:*

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lane obstructed;
- (d) Left land and right lane obstructed.

*Obstruction variables are illustrated in Figures 5.1 through 5.8

NSTRUCTOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPORT REQUIREMENTS:
ee Table 5-1	See Table 5-1	See Table 5-1

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SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 5

② MODULE TITLE: Collision Avoidance; Avoid striking lead vehicle.

⑦ SUBMODULE NO: 5.T.

⑧ SUBMODULE TITLE: Integrated Advanced Driving Range Test Debriefing; Subject's vehi either left rear (Condition #1) or right rear (Condition #2) of lead vehicle.

⑨ SUBMODULE OBJECTIVES:

(1) To provide to the student an immediate assessment of the level of performance achieved during the test, for the following conflicts:

- (a) Subject's vehicle closing on lead vehicle; will strike left rear quarter of lead vehicle (figure 5.1).
- (b) Subject's vehicle closing on lead vehicle; will strike right rear quarter of lead vehicle (figure 5.2).

(2) To provide to the student specific comments regarding deficiencies in performance and the corrective action required, and instances of superior performance.

(3) To gain from the student an immediate appraisal of difficulties encountered and reactions to the test.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will following obstruction variables:*

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lane obstructed;
- (d) Left and right lane obstructed.

*Obstruction variables are illustrated in F through 5.8

⑪ STUDENT MATERIALS:	⑫ INSTRUCTOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPORT R
See Table 5-1	See Table 5-1	See Table 5-1	See Tabl

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N FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

Collision Avoidance; Avoid striking lead vehicle.

: Integrated Advanced Driving Range Test Debriefing; Subject's vehicle will impact
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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will include the following obstruction variables:*

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lane obstructed;
- (d) Left and right lane obstructed.

*Obstruction variables are illustrated in Figures 5.1 through 5.8

NSTRUCTOR MATERIALS: ee Table 5-1	⑬ EVALUATION MATERIALS: See Table 5-1	⑭ SUPPORT REQUIREMENTS: See Table 5-1

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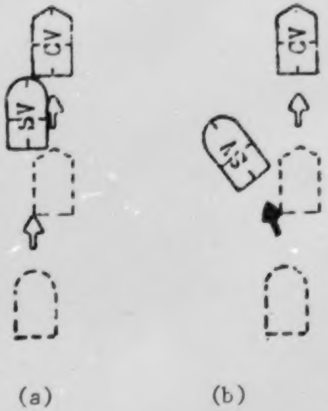
① MODULE NO: 5	② MODULE TITLE: Collision Avoidance; Avoid striking lead vehicle.

Figure 5.1: Lead vehicle obstacle; Will be struck by subject's vehicle at left rear quarter;
No obstructions.

(a) No avoidance response.

(b) Best chance: Brake and steer left.

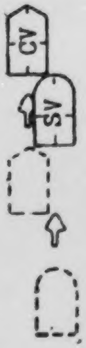


(a) (b)

Figure 5.2: Lead vehicle obstacle; Will be struck by subject's vehicle at right rear quarter;
No obstructions.

(a) No avoidance response.

(b) Best chance: Brake and steer right.

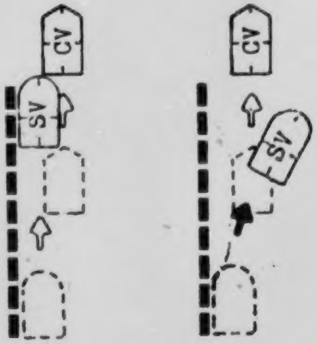


(a)

Figure 5.3: Lead vehicle obstacle; Will be struck by subject's vehicle at left rear quarter;
Left lane obstructed.

(a) No avoidance response.

(b) Best chance: Brake and steer right.

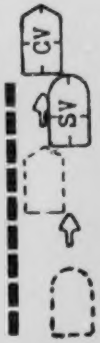


(a) (b)

Figure 5.4: Lead vehicle obstacle; Will be struck by subject's vehicle at right rear quarter;
Left lane obstructed.

(a) No avoidance response.

(b) Best chance: Brake and steer right.



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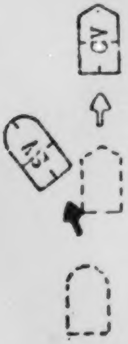
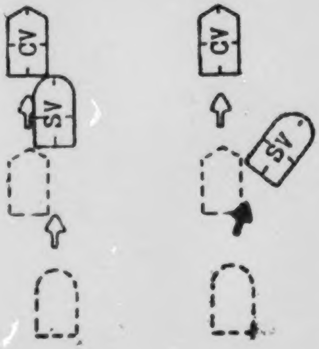


(b)

Figure 5.2: Lead vehicle obstacle; Will be struck by subject's vehicle at right rear quarter;
No obstructions.

(a) No avoidance response.

(b) Best chance: Brake and steer right.



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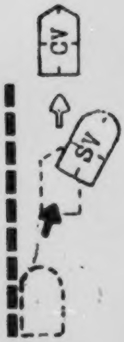
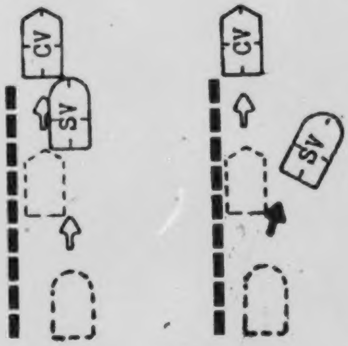


(b)

Figure 5.4: Lead vehicle obstacle; Will be struck by subject's vehicle at right rear quarter;
Left lane obstructed.

(a) No avoidance response.

(b) Best chance: Brake and steer right.



(a) (b)

① MODULE NO: 5	② MODULE TITLE: Collision Avoidance; Avoid striking lead vehicle.

Figure 5.5: Lead vehicle obstacle; Will be struck by subject's vehicle at left rear quarter;
Right lane obstructed.

(a) No avoidance response.

(b) Best chance: Brake and steer left.

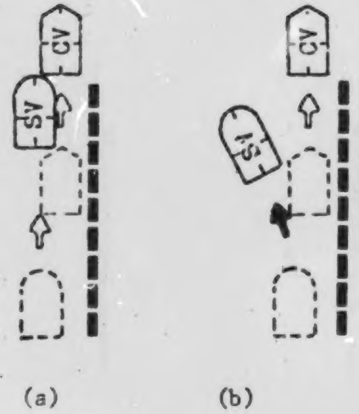


Figure 5.6: Lead vehicle obstacle; Will be struck by subject's vehicle at right rear quarter;
Right lane obstructed.

(a) No avoidance response.

(b) Best chance: Brake and steer left.

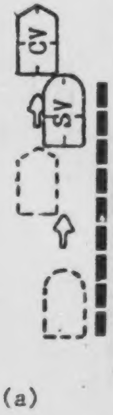


Figure 5.7: Lead vehicle obstacle; Will be struck by subject's vehicle at left rear quarter;
Left and right lane obstructed.

(a) No avoidance response.

(b) Best chance: Brake straight ahead.

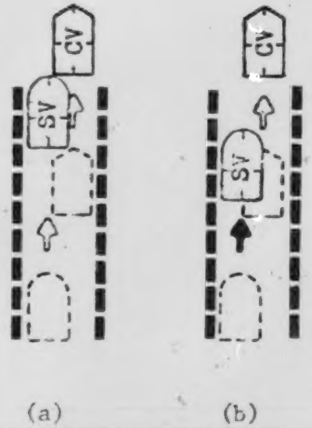
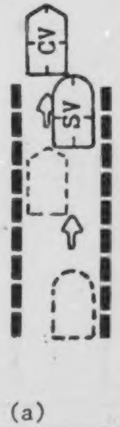


Figure 5.8: Lead vehicle obstacle; Will be struck by subject's vehicle at right rear quarter;
Left and right lane obstructed.

(a) No avoidance response.

(b) Best chance: Brake straight ahead.



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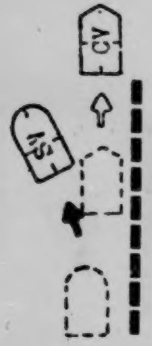
ion Avoidance; Avoid striking lead vehicle.

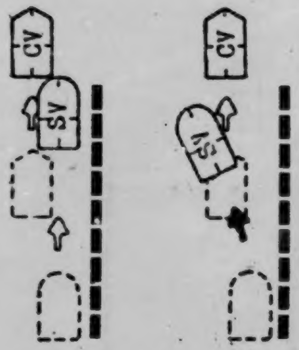


(b)

Figure 5.6: Lead vehicle obstacle; Will be struck by subject's vehicle at right rear quarter;
Right lane obstructed.

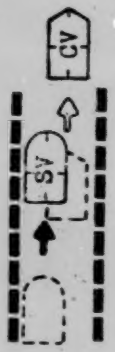
(a) No avoidance response.

(b) Best chance: Brake and steer left.



(a)

(b)

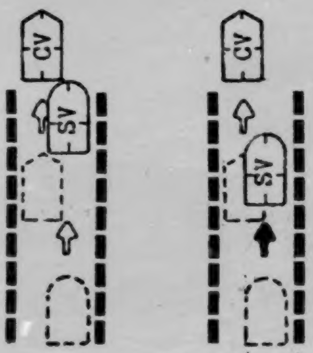


(b)

Figure 5.8: Lead vehicle obstacle; Will be struck by subject's vehicle at right rear quarter;
Left and right lane obstructed.

(a) No avoidance response.

(b) Best chance: Brake straight ahead.



(a)

(b)

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Table 5-1: TRAINING AND TESTING MATERIALS, EQUIPMENT, FACILITIES AND STAFF for MODULE # 5, Collision Avoidance, Lead Vehicle Obstacle

REQUIREMENT			USE	SUBMODULE																		NOTE
CODE		TITLE		A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	
0001	M	Course Summary	*	X																		
			#	X																		
0002	M	Module Summary, Module # 5	*	O	X							X										
			#	O	X							X										
0003	M	Course Schedule	*	O																		
			#	O																		
0004	M	Student Schedule Card	*	O	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
0005	M	Student Master Schedule	#	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	
0006	M	Range Layout Diagrams	*									O	O	X		O	X		O	X		
			#									O	X	X		X	X		O	X		
0003	M	BMS Instructions	*		O	X			X													
			#		X																	
0009	M	Range Instructions/ Safety	*									O	X	X		X	X		X	X		
			#									O	X	X		X	X		X	X		
0010	M	Equipment/Materials Checklist	#	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	
0012	M	Risk/Waiver Forms	#	O	X	X	X	X	X	X	X	O	X	X	X	X	X	X	X	X	X	
0013	M	Parental Consent Forms	#	O	X	X	X	X	X	X	X	O	X	X	X	X	X	X	X	X	X	4
0014	M	Instruction Procedure, Submodule	#	O	O	O	X	X	O	X	X	O	X	X	X	X	X	X	O	X	X	
0015	M	Content Material, Submodule	#	O	O	O	X	O	O	X	O	O	O	X	O	O	X	O	O	X	O	
0019	E	Movie Projector, 8mm	#	O																		3
0020	P	Instructor, Classroom(I)	@	O	O	O	O	O	O	O	O											
0021	P	Instructor,Classroom(II)	@	O	O	O	O		O	O												
0022	E	Bimodal Simulator (BMS)	@		O	O	O		O	O												
0023	M	Maneuvers List,Submodule	*	O	O	O			O			X	X			X			O			
			#	O	O	O			O			X	X			X			O			

See page B-12 of specification for explanation of symbols.

Table 5-1: TRAINING AND TESTING MATERIALS, EQUIPMENT, FACILITIES AND STAFF for MODULE #5 , Collision Avoidance, Lead Vehicle Obstacle

REQUIREMENT			USE	SUBMODULE																		NOTE
CODE		TITLE		A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	
0024	M	Maneuvers Description/ Illustration	*	O	O	O	X	X	O	X	X	O	O	X	X	O	X	X	O	X	X	
			#	O	X	X			X			X	X			X			O			
0025	M	Maneuvers Procedures	*	O	O	O			O			O	O			O			O			
			#	O	O	O			O			O	O	X		O	X		O	X		
0027	E	Screen, projection	#	O																		
0030	E	Projector, Movie, 16mm	@	O																		3
0032	M	Attendance Record	#	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	
0033	M	Student Performance Checklist	+			O	O		O	O			O	O		O	O			O		
			#					O			O				O			O			O	
0034	M	Video Tapes (Records)	#					O			O				O			O			O	
0035	P	Range Operations Coordinator	@									O	O	O		O	O			O		
0036	P	Instructor, Range (I)	@									O	O	O	O	O	O	O	O	O	O	
0037	P	Instructor, Range (II)	@									O	O	O		O	O			O		1
0038	F	Range, Auto Driving	@									O	O	O		O	O			O		
0039	E	Auto, Driver Training	@									O	O	O		O	O			O		1
0040	F	Classroom (I)	@	O																		2
0041	F	Classroom (II)	@		O	O	O	O	O	O	O				O			O	O		O	2
0042	E	Range marker cones	@									O	O	O		O	O			O		
0043	E	Range signal flags	@									O	O	O		O	O			O		
0044	M	Range marker stripes	@									O	O	O		O	O			O		
0045	E	Walkie-Talkies	@									O	O	O		O	O			O		
0046	E	Loudspeaker	@									O	O	O		O	O			O		
0047	E	First Aid Kit	@									X	X	X	X	X	X	X	X	X	X	
0048	E	Video Camera	+			O	O		O	O			O	O		O	O			O		
			@									O		O			O			O		

Table 5-1E TRAINING AND TESTING MATERIALS, EQUIPMENT, FACILITIES AND STAFF for MODULE #5 , **Collision Avoidance, Lead Vehicle Obstacle**

REQUIREMENT			USE	SUBMODULE																		NOTE
CODE		TITLE		A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	
0049	E	Video Recorder/Player	+			O	O		O	O			O	O		O	O			O		
			@					O			O			O			O			O		
0050	E	Video Monitor (I)	+			O	O	X	O	O	X		O	O	X	O	O	X		O	X	
0051	E	Video Monitor II	@		O	O	O	O	O	O	O											
0052	E	Crash Helmets	*									O	O	O		O	O			O		
			#									O	O	O		O	O			O		
0053	M	Range Operations Checklist	@									O	O	O		O	O			O		
0054	P	Range Crew	@									O	O	O		O	O			O		
0055	E	Range Support Vehicle	@									O	O	O		O	O			O		
0056	M	Maneuver Sequence List	*	O																		
			#	O			O			O				O			O			O		
0061	M	Simulator Film	#		O	O	O		O	O												
0062	M	Conflict Situation Movie	#	O																		
0063	M	Conflict Presentation Schedule	#				O			O		X	O	O		O	O			O		
0064	M	Conflict Situation Diagrams	*	O	X	X		X	X		X	X			X			X			X	
			#	O	X	X	X	X	X	X	X	X			X			X			X	
0065	E	Surrogate Vehicle	@									O	O	O		O	O			O		1
0066	E	Controller, Surrogate Vehicle	@									O										
			#										O	O		O	O			O		1
0067	E	Emergency Equipment	@									X	X	X		X	X			X		

NOTES: (1) Two are required.

(2) Choice of classroom based on recommended class size.

(3) Choice of projector depends on type of movie film used.

(4) If appropriate.

① MODULE NO:	② MODULE TITLE:
5	Collision Avoidance; Avoid striking lead vehicle

Table 5-2: Obstruction variables and best-chance avoidance maneuvers for lead vehicle obstacle conflict.

CONFLICT VARIABLES	KEY	MANEUVER ALTERNATIVES BY OBSTRUCTION VARIABLES			
		NO OBSTRUCTIONS	LEFT LANE OBSTRUCTED	RIGHT LANE OBSTRUCTED	LEFT AND RIGHT LANES OBSTRUCTED
Subject vehicle closing; will strike lead vehicle on left rear quarter. (Condition #1).	BEST CHANCE MANEUVER	Brake and steer left	Brake and steer right	Brake and steer left	Brake straight ahead
	RESULTANT	Avoidance	Avoidance (1)	Avoidance	Severity reduction
	ILLUSTRATION	FIG. 5.1	FIG. 5.3	FIG. 5.5	FIG. 5.7
Subject vehicle closing; will strike lead vehicle on right rear quarter. (Condition #2)	BEST CHANCE MANEUVER	Brake and steer right	Brake and steer right	Brake and steer left	Brake straight ahead
	RESULTANT	Avoidance	Avoidance	Avoidance (1)	Severity reduction
	ILLUSTRATION	FIG. 5.2	FIG. 5.4	FIG. 5.6	FIG. 5.8
	BEST CHANCE MANEUVER				
	RESULTANT				
	ILLUSTRATION	FIG.	FIG.	FIG.	FIG.
	BEST CHANCE MANEUVER				
	RESULTANT				
	ILLUSTRATION	FIG.	FIG.	FIG.	FIG.

NOTES:

(1) Less likely to achieve complete collision avoidance due to necessity of crossing path of CV.

(2) Not applicable, since the conflict vehicle is the primary straight-ahead obstruction.

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IDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

Avoidance; Avoid striking lead vehicle

nce avoidance maneuvers for lead vehicle obstacle conflict.

MANEUVER ALTERNATIVES BY OBSTRUCTION VARIABLES

NO OBSTRUCTIONS	LEFT LANE OBSTRUCTED	RIGHT LANE OBSTRUCTED	LEFT AND RIGHT LANES OBSTRUCTED	STRAIGHT AHEAD OBSTRUCTED(2)
ake and eer left	Brake and steer right	Brake and steer left	Brake straight ahead	N/A
oidance	Avoidance(1)	Avoidance	Severity reduction	
G. 5.1	FIG. 5.3	FIG. 5.5	FIG. 5.7	FIG.
ake and eer right	Brake and steer right	Brake and steer left	Brake straight ahead	N/A
oidance	Avoidance	Avoidance(1)	Severity reduction	
G. 5.2	FIG. 5.4	FIG. 5.6	FIG. 5.8	FIG.
G.	FIG.	FIG.	FIG.	FIG.
G.	FIG.	FIG.	FIG.	FIG.

ollision avoidance due to necessity of crossing path of CV.
t vehicle is the primary straight-ahead obstruction.

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ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING
CURRICULUM AND PERFORMANCE MEASUREMENT SPECIFICATION

MODULE NO: 6

COLLISION AVOIDANCE

AVOID HEAD-ON COLLISION WITH ONCOMING VEHICLE

(Oncoming Vehicle Threat)

SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 6

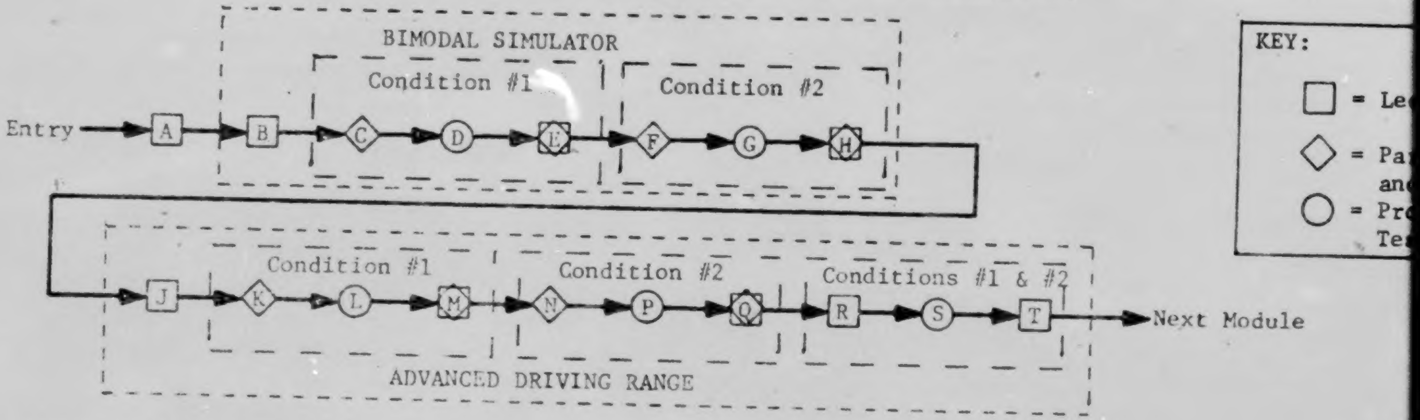
② MODULE TITLE: Collision Avoidance; Avoid head-on collision with oncoming vehicle.

③ PURPOSE OF MODULE: To provide students with the perceptual skills to recognize this type of conflict maneuvering skills to successfully avoid, or reduce the effects of, a collision.

④ STUDENT ENTRANCE PREREQUISITES: Completion of Module #1; A valid automobile operator's license.

⑤ APPLICABLE INSTRUCTION TECHNIQUES: Classroom lecture; Bimodal simulator; Advanced driving range.

⑥ INSTRUCTIONAL APPROACH: Instruction will be given in a series of submodules:



A: Lecture- Oncoming vehicle threat
B: Bimodal Simulator Demonstration
C: Simulator Practice, Condition #1
D: Simulator Test, Condition #1
E: Simulator Test Debriefing, Condition #1
F: Simulator Practice, Condition #2
G: Simulator Test, Condition #2
H: Simulator Test Debriefing, Condition #2
J: Advanced Driving Range Demonstration
K: Advanced Range Practice, Condition #1
L: Advanced Range Test, Condition #1
M: Advanced Range Test Debriefing, Condition #1
N: Advanced Range Practice, Condition #2
P: Advanced Range Test, Condition #2
Q: Advanced Range Test Debriefing, Condition #2
R: Pre-test Briefing, Advanced Range, Integrated Co
S: Advanced Range Test, Integrated Conditions #1 an
T: Advanced Range Test Debriefing, Integrated Cond

CONDITIONS:

#1 - Oncoming vehicle will strike subject's vehicle quarter if not successfully avoided.

#2 - Oncoming vehicle will strike subject's vehicle quarter if not successfully avoided.

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ION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

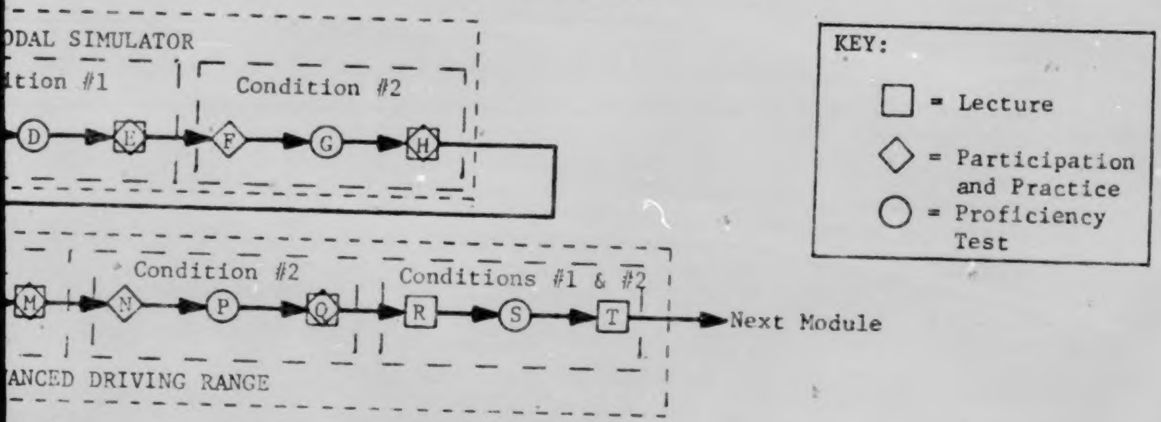
E: Collision Avoidance; Avoid head-on collision with oncoming vehicle.

students with the perceptual skills to recognize this type of conflict, and the
g skills to successfully avoid, or reduce the effects of, a collision.

: Completion of Module #1; A valid automobile operator's license.

QUES: Classroom lecture; Bimodal simulator; Advanced driving range.

uction will be given in a series of submodules:


DAL SIMULATOR
ition #1
Condition #2
D
E
F
G
H
Condition #2
Conditions #1 & #2
M
N
P
Q
R
S
T
Next Module
ANCED DRIVING RANGE
KEY:
= Lecture
= Participation and Practice
= Proficiency Test

eat
on
#1

ndition #1
#2

ndition #2
ration
ition #1
#1

M: Advanced Range Test Debriefing, Condition #1
N: Advanced Range Practice, Condition #2
P: Advanced Range Test, Condition #2
Q: Advanced Range Test Debriefing, Condition #2
R: Pre-test Briefing, Advanced Range, Integrated Conditions
S: Advanced Range Test, Integrated Conditions #1 and #2.
T: Advanced Range Test Debriefing, Integrated Conditions #1 & 2

CONDITIONS:

#1 - Oncoming vehicle will strike subject's vehicle at left front quarter if not successfully avoided.

#2 - Oncoming vehicle will strike subject's vehicle at right front quarter if not successfully avoided.

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① MODULE NO: 6

② MODULE TITLE: Collision Avoidance; Avoid head-on collision with oncoming vehicle.

⑦ SUBMODULE NO: 6.A

⑧ SUBMODULE TITLE: Lecture - Oncoming vehicle threat.

⑨ SUBMODULE OBJECTIVES:

(1) To develop in the student a cognizance of the characteristics of the onset conditions and potentially successful response maneuvers for the following conflict situations:

- (a) Subject's vehicle being approached head-on by oncoming vehicle; will be struck at left-front quarter (figure 6.1);
- (b) Subject's vehicle being approached head-on by oncoming vehicle; will be struck at right-front quarter (figure 6.2).

(2) To develop in the student a visual image of the characteristics of the onset conditions, multi-vehicle dynamics, and response maneuvers for the above conflict situations.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will following obstruction variables: *

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lane obstructed;
- (d) Left lane and right lane obstruct

*Obstruction variables are illustrated in fi through 6.8

⑪ STUDENT MATERIALS:	⑫ INSTRUCTOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPORT R
See Table 6-1	See Table 6-1	See Table 6-1	See Table

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FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

llision Avoidance; Avoid head-on collision with oncoming vehicle.

Lecture - Oncoming vehicle threat.

izance of the
ditions and potenti-
rs for the following

oached head-on by
ruck at left-front

oached head-on by
ruck at right-

al image of the
ditions, multi-
aneuvers for the

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will include the following obstruction variables: *

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left lane and right lane obstructed.

*Obstruction variables are illustrated in figures 6.1 through 6.8

RUCTOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPORT REQUIREMENTS:
Table 6-1	See Table 6-1	See Table 6-1

pared G. R. Hatterick	Approved By:	Page 6-2

SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 6	② MODULE TITLE: Collision Avoidance; Avoid head-on collision with oncoming vehicle.
⑦ SUBMODULE NO: 6.B.	⑧ SUBMODULE TITLE: Bimodal Simulator Demonstration; Oncoming vehicle threat.

⑨ SUBMODULE OBJECTIVES:

(1) To familiarize the student with the characteristics of the onset conditions and potentially successful response maneuvers, as they will appear in simulation, for the following conflict situations:

- (a) Subject's vehicle being approached head-on by oncoming vehicle; will be struck at left-front quarter (figure 6.1);
- (b) Subject's vehicle being approached head-on by oncoming vehicle; will be struck at right-front quarter (figure 6.2).

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will
following obstruction variables: *

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lane obstructed;
- (d) Left lane and right lane obstru

*Obstruction variables are illustrated in
through 6.8

⑪ STUDENT MATERIALS:	⑫ INSTRUCTOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPORT
See Table 6-1	See Table 6-1	See Table 6-1	See Tab

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FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

ollision Avoidance; Avoid head-on collision with oncoming vehicle.

Bimodal Simulator Demonstration; Oncoming vehicle threat.

he characteristics
ntially successful
appear in simulation,
tions:

oached head-on by
ruck at left-front

oached head-on by
ruck at right-front

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will include the following obstruction variables: *

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left lane and right lane obstructed.

*Obstruction variables are illustrated in Figures 6.1 through 6.8

STRUCTOR MATERIALS: e Table 6-1	⑬ EVALUATION MATERIALS: See Table 6-1	⑭ SUPPORT REQUIREMENTS: See Table 6-1

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SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 6	② MODULE TITLE: Collision Avoidance; Avoid head-on collision with oncoming vehicle
⑦ SUBMODULE NO: 6.C.	⑧ SUBMODULE TITLE: Bimodal Simulator Practice; Oncoming vehicle will strike left fr subject's car (Condition #1).

⑨ SUBMODULE OBJECTIVES:

(1) Train student drivers to recognize the onset of this conflict situation at the earliest possible moment:

- (a) Subject's vehicle being approached head-on by oncoming vehicle; will be struck at left front quarter (figure 6.1).

(2) Train student drivers to instantaneously select, from the available choices, the alternative which will most likely avoid, or minimize the effects of, a collision; (see Table 6-2)

(3) Train student drivers to effectively implement the alternative selected through evasive maneuvering of their vehicle.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations wil
following obstruction variables: *

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lane obstructed;
- (d) Left lane and right lane obstru

*Obstruction variables are illustrated in F
6.8

⑪ STUDENT MATERIALS:	⑫ INSTRUCTOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPORT
See Table 6-1	See Table 6-1	See Table 6-1	See Tab

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FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

ollision Avoidance; Avoid head-on collision with oncoming vehicle.

Bimodal Simulator Practice; Oncoming vehicle will strike left front quarter of subject's car (Condition #1).

ize the onset of
earliest possible

roached head-on by
truck at left front

taneously select,
alternative which
mize the effects

ively implement the
asive maneuvering

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will include the following obstruction variables:*

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left lane and right lane obstructed.

*Obstruction variables are illustrated in Figures 6.1 through 6.8

RUCTOR MATERIALS: Table 6-1	⑬ EVALUATION MATERIALS: See Table 6-1	⑭ SUPPORT REQUIREMENTS: See Table 6-1

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SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 6

② MODULE TITLE: Collision Avoidance; Avoid head-on collision with oncoming vehicle.

⑦ SUBMODULE NO: 6.D.

⑧ SUBMODULE TITLE: Bimodal Simulator Test; Oncoming vehicle will strike left front
subject's car (Condition #1).

⑨ SUBMODULE OBJECTIVES:

(1) To ascertain that each student has learned to recognize the precursor conditions of this conflict situation as soon as they appear:

(a) Subject's vehicle being approached head-on by oncoming vehicle; will be struck at left front quarter (figure 6.1).

(2) To determine that the student has learned to select the most feasible alternative available to either avoid, or reduce the effects of, a collision resulting from this conflict;

(3) To determine that the student has learned to effectively implement the avoidance maneuver selected in this conflict situation.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will
following obstruction variables:*

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left lane and right lane obstruc

*Obstruction variables are illustrated in F
through 6.8

⑪ STUDENT MATERIALS:	⑫ INSTRUCTOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPORT R
See Table 6-1	See Table 6-1	See Table 6-1	See Tabl

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R ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

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imodal Simulator Test; Oncoming vehicle will strike left front quarter of
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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will include the following obstruction variables:*

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left lane and right lane obstructed.

*Obstruction variables are illustrated in Figures 6.1 through 6.8

CTOR MATERIALS: ble 6-1	⑬ EVALUATION MATERIALS: See Table 6-1	⑭ SUPPORT REQUIREMENTS: See Table 6-1

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SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 6

② MODULE TITLE: Collision Avoidance; Avoid head-on collision with oncoming vehicle.

⑦ SUBMODULE NO: 6.E.

⑧ SUBMODULE TITLE: Bimodal Simulator Test Debriefing; Oncoming vehicle will impact le
of subject's vehicle (Condition #1).

⑨ SUBMODULE OBJECTIVES:

(1) To provide to the student an immediate assessment of the level of performance achieved during the test for the following conflict situations:

   (a) Subject's vehicle being approached head-on by oncoming vehicle; will be struck at left front quarter (Figure 6.1).

(2) To provide to the student specific comments regarding deficiencies in performance and the corrective action required, and instances of superior performance.

(3) To gain from the student an immediate appraisal of difficulties encountered and reactions to the test.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will
following obstruction variables: *

   (a) No obstructions;
   (b) Left lane obstructed;
   (c) Right lane obstructed;
   (d) Left lane and right lane obstruct

*Obstruction variables are illustrated in Fig
through 6.8

⑪ STUDENT MATERIALS: See Table 6-1

⑫ INSTRUCTOR MATERIALS: See Table 6-1

⑬ EVALUATION MATERIALS: See Table 6-1

⑭ SUPPORT R
See Table

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CATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

E: Collision Avoidance; Avoid head-on collision with oncoming vehicle.

ITLE: Bimodal Simulator Test Debriefing; Oncoming vehicle will impact left front quarter of subject's vehicle (Condition #1).

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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will include the following obstruction variables: *

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lane obstructed;
- (d) Left lane and right lane obstructed.

*Obstruction variables are illustrated in Figures 6.1 through 6.8

INSTRUCTOR MATERIALS:

See Table 6-1

⑬ EVALUATION MATERIALS:

See Table 6-1

⑭ SUPPORT REQUIREMENTS:

See Table 6-1

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SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 6

② MODULE TITLE: Collision Avoidance; Avoid head-on collision with oncoming vehicle.

⑦ SUBMODULE NO: 6.F

⑧ SUBMODULE TITLE: Bimodal Simulator Practice; Oncoming vehicle will strike right fr of subject's car (Condition #2).

⑨ SUBMODULE OBJECTIVES:

(1) Train student drivers to recognize the onset of this conflict situation at the earliest possible moment:

  (a) Subject's vehicle being approached head-on by oncoming vehicle; will be struck at right front quarter (figure 6.2).

(2) Train student drivers to instantaneously select, from the available choices, the alternative which will most likely avoid, or minimize the effects of, a collision. (See Table 6-2)

(3) Train student drivers to effectively implement the alternative selected throught evasive maneuvering of their vehicle.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will following obstruction variables: *

  (a) No obstructions;
  (b) Left lane obstructed;
  (c) Right lane obstructed;
  (d) Left lane and right lane obstruc

*Obstruction variables are illustrated in through 6.8

⑪ STUDENT MATERIALS:	⑫ INSTRUCTOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPORT
See Table 6-1	See Table 6-1	See Table 6-1	See Tabl

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ION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will include the following obstruction variables: *

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left lane and right lane obstructed.

*Obstruction variables are illustrated in Figures 6.1 through 6.8

INSTRUCTOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPORT REQUIREMENTS:
See Table 6-1	See Table 6-1	See Table 6-1

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SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 6

② MODULE TITLE: Collision Avoidance; Avoid head-on collision with oncoming vehicle.

⑦ SUBMODULE NO: 6.G

⑧ SUBMODULE TITLE: Bimodal Simulator Test; Oncoming vehicle will strike right front
of subject's car (Condition #2)

⑨ SUBMODULE OBJECTIVES:

(1) To ascertain that each student has learned to recognize the precursor conditions of this conflict situation as soon as they appear:

(a) Subject's vehicle being approached head-on by oncoming vehicle; will be struck at right front quarter (figure 6.2).

(2) To determine that the student has learned to select the most feasible alternaitve avilable to either avoid, or reduce the effects of, a collision resulting from this conflict.

(3) To determine that the student has learned to effectively implement the avoidance maneuver selected in this conflict situation.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will
following obstruction variables: *

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left lane and right lane obstruc

*Obstruction variables are illustrated in F
through 6.8

⑪ STUDENT MATERIALS:

See Table 6-1

⑫ INSTRUCTOR MATERIALS:

See Table 6-1

⑬ EVALUATION MATERIALS:

See Table 6-1

⑭ SUPPORT R

See Table

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N FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

Collision Avoidance; Avoid head-on collision with oncoming vehicle.

: Bimodal Simulator Test; Oncoming vehicle will strike right front quarter of subject's car (Condition #2)

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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will include the following obstruction variables: *

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left lane and right lane obstructed.

*Obstruction variables are illustrated in Figures 6.1 through 6.8

RUCTOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPORT REQUIREMENTS:
Table 6-1	See Table 6-1	See Table 6-1

epared : G. R. Hatterick	Approved By:	Page 6-8

SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 6	② MODULE TITLE: Collision Avoidance; Avoid head-on collision with oncoming vehicle.
⑦ SUBMODULE NO: 6.H	⑧ SUBMODULE TITLE: Bimodal Simulator Test Debriefing; Oncoming vehicle will impact rig quarter of subject's vehicle (Condition #2).

⑨ SUBMODULE OBJECTIVES:

(1) To provide to the student an immediate assessment of the level of performance achieved during the test for the following conflict situation:

(a) Subject's vehicle being approached head-on by oncoming vehicle; will be struck at right front quarter (figure 6.2).

(2) To provide to the student specific comments regarding deficiencies in performance and the corrective action required, and instances of superior performance.

(3) To gain from the student an immediate appraisal of difficulties encountered and reactions to the test.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will
following obstruction variables: *

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left lane and right lane obstruct

*Obstruction variables are illustrated in Fi
through 6.8

⑪ STUDENT MATERIALS: See Table 6-1	⑫ INSTRUCTOR MATERIALS: See Table 6-1	⑬ EVALUATION MATERIALS: See Table 6-1	⑭ SUPPORT RE See Table

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FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will include the following obstruction variables: *

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left lane and right lane obstructed.

*Obstruction variables are illustrated in Figures 6.1 through 6.8

RUCTOR MATERIALS: Table 6-1	⑬ EVALUATION MATERIALS: See Table 6-1	⑭ SUPPORT REQUIREMENTS: See Table 6-1

epared : G. R. Hatterick	Approved By:	Page 6-9

SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 6	② MODULE TITLE: Collision Avoidance; Avoid head-on collision with oncoming vehicle
⑦ SUBMODULE NO: 6.J	⑧ SUBMODULE TITLE: Advanced Driving Range Demonstration; Oncoming vehicle threat.

⑨ SUBMODULE OBJECTIVES:

(1) To familiarize the student with the characteristics of the onset conditions and potentially successful response maneuvers, as they will appear on the driving range, for the following conflict situations;

- (a) Subject's vehicle being approached head-on by oncoming vehicle; will be struck at left-front quarter (figure 6.1);
- (b) Subject's vehicle being approached head-on by oncoming vehicle; will be struck at right-front quarter (figure 6.2).

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations wil
following obstruction variables: *

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lane obstructed;
- (d) Left lane and right lane obstru

(2) Only student participants and requir
staff will be permitted on the range
submodule.

(3) All range safety equipment and proce
verified prior to initiating demonst

(4) Range Safety Monitor must be on duty
during the use of the range.

*Obstruction variables are illustrated in
through 6.8

⑪ STUDENT MATERIALS:	⑫ INSTRUCTOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPORT
See Table 6-1	See Table 6-1	See Table 6-1	See Tab

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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will include the following obstruction variables: *

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left lane and right lane obstructed.

(2) Only student participants and required instructor staff will be permitted on the range during this submodule.

(3) All range safety equipment and procedures will be verified prior to initiating demonstration.

(4) Range Safety Monitor must be on duty at all times during the use of the range.

*Obstruction variables are illustrated in Figures 6.1 through 6.8

CTOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPORT REQUIREMENTS:
le 6-1	See Table 6-1	See Table 6-1

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SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 6

② MODULE TITLE: Collision Avoidance; Avoid head-on collision with oncoming vehicle.

⑦ SUBMODULE NO: 6.K

⑧ SUBMODULE TITLE: Advanced Driving Range Practice: Oncoming vehicle will strike left quarter of subject's car (Condition #1).

⑨ SUBMODULE OBJECTIVES:

(1) Train student drivers to recognize the onset of this conflict situation at the earliest possible moment:

(a) Subject's vehicle being approached head-on by oncoming vehicle; will be struck at left-front quarter (figure 6.1).

(2) Train student drivers to instantaneously select, from the available choices, the alternative which will most likely avoid, or minimize the effects of, a collision. (See Table 6-2)

(3) Train student drivers to effectively implement the alternative selected through evasive maneuvering of their vehicle.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Only student participants and required staff will be permitted on the range du submodule.

(2) All range safety equipment and procedur verified prior to initiating student pr

(3) Range Safety Monitor must be on duty at during the use of the range.

(4) Each of the conflict situations will in following obstruction variables: *

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left lane and right lane obstructe

*Obstruction variables are illustrated in through 6.8

⑪ STUDENT MATERIALS: See Table 6-1

⑫ INSTRUCTOR MATERIALS: See Table 6-1

⑬ EVALUATION MATERIALS: See Table 6-1

⑭ SUPPORT R See Tabl

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Prepared By: G. R. Hatterick

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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Only student participants and required instructor staff will be permitted on the range during this submodule.

(2) All range safety equipment and procedures will be verified prior to initiating student practice sessions.

(3) Range Safety Monitor must be on duty at all times during the use of the range.

(4) Each of the conflict situations will include the following obstruction variables: *

(a) No obstructions:
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left lane and right lane obstructed.

*Obstruction variables are illustrated in Figures 6.1 through 6.8

OR MATERIALS: e 6-1	⑬ EVALUATION MATERIALS: See Table 6-1	⑭ SUPPORT REQUIREMENTS: See Table 6-1

ed G. R. Hatterick	Approved By:	Page 6-11

SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 6

② MODULE TITLE: Collision Avoidance; Avoid head-on collision with oncoming vehicle.

⑦ SUBMODULE NO: 6.L

⑧ SUBMODULE TITLE: Advanced Driving Range Test; Oncoming vehicle will strike left f
of subject's car (Condition #1).

⑨ SUBMODULE OBJECTIVES:

(1) To ascertain that each student has learned to recognize the precursor conditions of this conflict situation as soon as they appear:

(a) Subject's vehicle being approached head-on by oncoming vehicle; will be struck at left front quarter (figure 6.1).

(2) To determine that the student has learned to select the most feasible alternative available to either avoid, or reduce the effects of, [illegible]ollision resulting from this conflict.

(3) To determine that the student has [illegible]rned to effectively implement the avoidance maneuver selected in this conflict situation.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Only student participants and require
staff will be permitted on the range
submodule.

(2) All range safety equipment and proced
verified prior to initiating student

(3) Range Safety Monitor must be on duty
during the use of the range.

(4) Each of the conflict situations will
following obstruction variables: *

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left lane and right lane obstructe

*Obstruction variables are illustrated i
through 6.8

⑪ STUDENT MATERIALS: See Table 6-1

⑫ INSTRUCTOR MATERIALS: See Table 6-1

⑬ EVALUATION MATERIALS: See Table 6-1

⑭ SUPPORT
See Tab

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Prepared By: G. R. Hatterick

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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Only student participants and required instructor staff will be permitted on the range during this submodule.

(2) All range safety equipment and procedures will be verified prior to initiating student test sessions.

(3) Range Safety Monitor must be on duty at all times during the use of the range.

(4) Each of the conflict situations will include the following obstruction variables: *

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left lane and right lane obstructed.

*Obstruction variables are illustrated in Figures 6.1 through 6.8

OR MATERIALS:

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⑬ EVALUATION MATERIALS:

See Table 6-1

⑭ SUPPORT REQUIREMENTS:

See Table 6-1

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SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 6	② MODULE TITLE: Collision Avoidance; Avoid head-on collision with oncoming vehicl
⑦ SUBMODULE NO: 6.M	⑧ SUBMODULE TITLE: Advanced Driving Range Test Debriefing; Oncoming vehicle will i quarter of subject's vehicle (Condition #1).

⑨ SUBMODULE OBJECTIVES:

(1) To provide to the student an immediate assessment of the level of performance achieved during the test, for the following conflict situation :

(a) Subject's vehicle being approached head-on by on-coming vehicle; will be struck at left front quarter (figure 6.1).

(2) To provide to the student specific comments regarding deficiencies in performance and the corrective action required, and instances of superior performance.

(3) To gain from the student an immediate appraisal of difficulties encountered and reactions to the test.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations w
following obstruction variables: *

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left lane and right lane obst

*Obstruction variables are illustrated
through 6.8

⑪ STUDENT MATERIALS: See Table 6-1	⑫ INSTRUCTOR MATERIALS: See Table 6-1	⑬ EVALUATION MATERIALS: See Table 6-1	⑭ SUPPO See T

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ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will include the following obstruction variables: *

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left lane and right lane obstructed.

*Obstruction variables are illustrated in Figures 6.1 through 6.8

TOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SPECIAL SUPPORT REQUIREMENTS:
le 6-1	See Table 6-1	See Table 6-1

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① MODULE NO: 6	② MODULE TITLE: Collision Avoidance; Avoid head-on collision with oncoming vehicle.
⑦ SUBMODULE NO: 6.N	⑧ SUBMODULE TITLE: Advanced Driving Range Practice; Oncoming vehicle will strike ri quarter of subject's car (Condition #2).

⑨ SUBMODULE OBJECTIVES:

(1) Train student drivers to recognize the onset of this conflict situation at the earliest possible moment:

(a) subject's vehicle being approached head-on by oncoming vehicle: will be struck at right front quarter (figure 6.2).

(2) Train student drivers to instantaneously select, from the available choices, the alternative which will most likely avoid, or minimize the effects of, a collision. (See Table 6-2)

(3) Train student drivers to effectively implement the alternative selected through evasive maneuvering of their vehicle.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Only student participants and required
staff will be permitted on the range d
submodule.

(2) All range safety equipment and procedu
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(3) Range Safety Monitor must be on duty a
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(4) Each of the conflict situations will in
following obstruction variables: *

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left lane and right lane obstructed

*Obstruction variables are illustrated in
through 6.8

⑪ STUDENT MATERIALS:	⑫ INSTRUCTOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPORT R
See Table 6-1	See Table 6-1	See Table 6-1	See Tabl

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ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Only student participants and required instructor staff will be permitted on the range during this submodule.

(2) All range safety equipment and procedures will be verified prior to initiating student practice sessions.

(3) Range Safety Monitor must be on duty at all times during the use of the range.

(4) Each of the conflict situations will include the following obstruction variables: *

- (a) No obstructions:
- (b) Left lane obstructed;
- (c) Right lane obstructed;
- (d) Left lane and right lane obstructed.

*Obstruction variables are illustrated in Figures 6.1 through 6.8

MATERIALS:

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⑬ EVALUATION MATERIALS:

See Table 6-1

⑭ SUPPORT REQUIREMENTS:

See Table 6-1

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Approved By:

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① MODULE NO: 6	② MODULE TITLE: Collision Avoidance; Avoid head-on collision with oncoming vehicle.
⑦ SUBMODULE NO: 6.P	⑧ SUBMODULE TITLE: Advanced Driving Range Test; Oncoming vehicle will strike right of subject's car (Condition #2).

⑨ SUBMODULE OBJECTIVES:

(1) To ascertain that each student has learned to recognize the precursor conditions of this conflict situation as soon as they appear:

(a) Subject's vehicle being approached head-on by oncoming vehicle; will be struck at right front quarter (figure 6.2).

(2) To determine that the student has learned to select the most feasible alternative available to either avoid, or reduce the effects of, a collision resulting from this conflict.

(3) To determine that the student has learned to effectively implement the avoidance maneuver selected in this conflict situation.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Only student participants and requir
staff will be permitted on the range
submodule.

(2) All range safety equipment and proce
verified prior to initiating student

(3) Range Safety Monitor must be on duty
during the use of the range.

(4) Each of the conflict situations will
following obstruction variables; *

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left lane and right lane obstruc

*Obstruction variables are illustrated in
through 6.8

⑪ STUDENT MATERIALS: See Table 6-1	⑫ INSTRUCTOR MATERIALS: See Table 6-1	⑬ EVALUATION MATERIALS: See Table 6-1	⑭ SUPPORT See Tabl

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ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Only student participants and required instructor staff will be permitted on the range during this submodule.

(2) All range safety equipment and procedured will be verified prior to initiating student test sessions.

(3) Range Safety Monitor must be on duty at all times during the use of the range.

(4) Each of the conflict situations will include the following obstruction variables; *

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lane obstructed;
- (d) Left lane and right lane obstructed.

*Obstruction variables are illustrated in Figures 6.1 through 6.8

TOR MATERIALS:

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⑬ EVALUATION MATERIALS:

See Table 6-1

⑭ SUPPORT REQUIREMENTS:

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SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 6

② MODULE TITLE: Collision Avoidance; Avoid head-on collision with oncoming vehicle.

⑦ SUBMODULE NO: 6.Q

⑧ SUBMODULE TITLE: Advanced Driving Range Test Debriefing: Oncoming vehicle will imp
front quarter of subject's vehicle (Condition #2).

⑨ SUBMODULE OBJECTIVES:

(1) To provide to the student an immediate assessment of the level of performance achieved during the test, for the following conflict:

  (a) Subject's vehicle being approached head-on by oncoming vehicle; will be struck at right front quarter (figure 6.2).

(2) To provide to the student specific comments regarding deficiencies in performance and the corrective action required, and instances of superior performance.

(3) To gain from the student an immediate appraisal of difficulties encountered and reactions to the test.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations wil
following obstruction variables:*

  (a) No obstructions;
  (b) Left lane obstructed;
  (c) Right lane obstructed;
  (d) Left lane and right lane obstruc

*Obstruction variables are illustrated in
through 6.8

⑪ STUDENT MATERIALS: See Table 6-1

⑫ INSTRUCTOR MATERIALS: See Table 6-1

⑬ EVALUATION MATERIALS: See Table 6-1

⑭ SUPPORT
See Tab

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OR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

lision Avoidance; Avoid head-on collision with oncoming vehicle.

Advanced Driving Range Test Debriefing: Oncoming vehicle will impact right front quarter of subject's vehicle (Condition #2).

assessment of the
he test, for the

head-on by
t right front

ments regarding
rrective action
rformance.

appraisal of
to the test.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will include the following obstruction variables:*

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left lane and right lane obstructed.

*Obstruction variables are illustrated in Figures 6.1 through 6.8

CTOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPORT REQUIREMENTS:
ble 6-1	See Table 6-1	See Table 6-1

ered G. R. Hatterick	Approved By:	Page 6-16

SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 6	② MODULE TITLE: Collision Avoidance; Avoid head-on collision with oncoming vehicle.
⑦ SUBMODULE NO: 6.R	⑧ SUBMODULE TITLE: Pre-Test Briefing, Advanced Driving Range Test; Oncoming vehicle ma either the left front (Condition #1) or right front (Condition #2) of th vehicle.

⑨ SUBMODULE OBJECTIVES:

(1) To prepare the student for conduct of the integrated testing submodule by describing the scope of the test, reviewing the characteristics of the included conflict situations, and describing the maneuvers most likely to be successful for the following conflict situations:

- (a) Subject's vehicle being approached head-on by oncoming vehicle; will be struck at left-front quarter (figure 6.1);
- (b) Subject's vehicle being approached head-on by oncoming vehicle; will be struck at right front quarter (figure 6.2).

(2) To assure that the student comprehends the need to select the most appropriate course of evasive action based on the specific characteristics of the conflict situations confronting him.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will following obstruction variables:*

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lane obstructed;
- (d) Left lane and right lane obstruct

*Obstruction variables are illustrated in F through 6.8

⑪ STUDENT MATERIALS:	⑫ INSTRUCTOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPORT F
See Table 6-1	See Table 6-1	See Table 6-1	See Tabl

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ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

sion Avoidance; Avoid head-on collision with oncoming vehicle.

-Test Briefing, Advanced Driving Range Test; Oncoming vehicle may strike
he left front (Condition #1) or right front (Condition #2) of the subject's

he integrated
pe of the test,
cluded conflict
s most likely to
t situations :

head-on by
left-front

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right front

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evasive action
of the conflict

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will include the following obstruction variables:*

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left lane and right lane obstructed.

*Obstruction variables are illustrated in Figures 6.1 through 6.8

CTOR MATERIALS: ble 6-1	⑬ EVALUATION MATERIALS: See Table 6-1	⑭ SUPPORT REQUIREMENTS: See Table 6-1

pared G. R. Hatterick	Approved By:	Page 6-17

① MODULE NO: 6	② MODULE TITLE: Collision Avoidance; Avoid head-on collision with oncoming vehicle.
⑦ SUBMODULE NO: 6.S	⑧ SUBMODULE TITLE: Integrated Advanced Driving Range Test; Oncoming vehicle may st left front (Condition #1) or the right front (Condition #2) of the subject's ca

⑨ SUBMODULE OBJECTIVES:

(1) To ascertain that each student has learned to recognize the precursor conditions of these conflict situations as soon as they appear:

- (a) Subject's vehicle being approached head-on by oncoming vehicle; will be struck at left-front quarter (figure 6.1);
- (b) Subject's vehicle being approached head-on by oncoming vehicle; will be struck at right front quarter (figure 6.2).

(2) To determine that the student has learned to select the most feasible alternative available to either avoid, or reduce the effects of, a collision resulting from this conflict.

(3) To determine that the student has learned to effectively implement the avoidance maneuver selected in this conflict situation.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Only student participants and require
staff will be permitted on the range
submodule.

(2) All range safety equipment and procedu
verified prior to initiating student

(3) Range Safety Monitor must be on duty
during the use of the range.

(4) Each of the conflict situations will
following obstruction variables; *

- (a) No obstructions;
- (b) Left lane obstructed;
- (c) Right lane obstructed;
- (d) Left lane and right lane obstructe

*Obstruction variables are illustrated in
through 6.8

⑪ STUDENT MATERIALS: See Table 6-1	⑫ INSTRUCTOR MATERIALS: See Table 6-1	⑬ EVALUATION MATERIALS: See Table 6-1	⑭ SUPPORT See Tab

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FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

llision Avoidance; Avoid head-on collision with oncoming vehicle.

Integrated Advanced Driving Range Test; Oncoming vehicle may strike either the
ndition #1) or the right front (Condition #2) of the subject's car.

as learned to recog-
these conflict
:

oached head-on by
ruck at left-front

oached head-on by
ruck at right front

learned to select
ilable to either
a collision re-

learned to
ce maneuver
on.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Only student participants and required instructor staff will be permitted on the range during this submodule.

(2) All range safety equipment and procedures will be verified prior to initiating student test sessions.

(3) Range Safety Monitor must be on duty at all times during the use of the range.

(4) Each of the conflict situations will include the following obstruction variables: *

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left lane and right lane obstructed.

*Obstruction variables are illustrated in Figures 6.1 through 6.8

RUCTOR MATERIALS:

Table 6-1

⑬ EVALUATION MATERIALS:

See Table 6-1

⑭ SUPPORT REQUIREMENTS:

See Table 6-1

epared
: G. R. Hatterick

Approved
By:

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SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 6

② MODULE TITLE: Collision Avoidance; Avoid head-on collision with oncoming vehicle.

⑦ SUBMODULE NO: 6.T

⑧ SUBMODULE TITLE: Integrated Advanced Driving Range Test Debriefing; Oncoming vehicl either left front (Condition #1) or right front (Condition #2) of subject's vehicl

⑨ SUBMODULE OBJECTIVES:

(1) To provide to the student an immediate assessment of the level of performance achieved during the test, for the following conflicts:

  (a) Subject's vehicle being approached head-on by oncoming vehicle; will be struck at left-front quarter (figure 6.1);
  (b) Subject's vehicle being approached head-on by oncoming vehicle; will be struck at right-front quarter (figure 6.2).

(2) To provide to the student specific comments regarding deficiencies in performance and the corrective action required, and instances of superior performance.

(3) To gain from the student an immediate appraisal of difficulties encountered and reactions to the test.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations wil following obstruction variables:*

  (a) No obstructions;
  (b) Left lane obstructed;
  (c) Right lane obstructed;
  (d) Left lane and right lane obstru

*Obstruction variables are illustrated in through 6.8

⑪ STUDENT MATERIALS:

See Table 6-1

⑫ INSTRUCTOR MATERIALS:

See Table 6-1

⑬ EVALUATION MATERIALS:

See Table 6-1

⑭ SUPPORT

See Tab

Issue Date: 12/30/75

Revision No: 2

Prepared By: C. R. Hatterick

Approved By:

Pa

R ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

ision Avoidance; Avoid head-on collision with oncoming vehicle.

tegrated Advanced Driving Range Test Debriefing; Oncoming vehicle will impact
(Condition #1) or right front (Condition #2) of subject's vehicle.

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at right-front

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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Each of the conflict situations will include the following obstruction variables: *

(a) No obstructions;
(b) Left lane obstructed;
(c) Right lane obstructed;
(d) Left lane and right lane obstructed.

*Obstruction variables are illustrated in Figures 6.1 through 6.8

UCTOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPORT REQUIREMENTS:
able 6-1	See Table 6-1	See Table 6-1

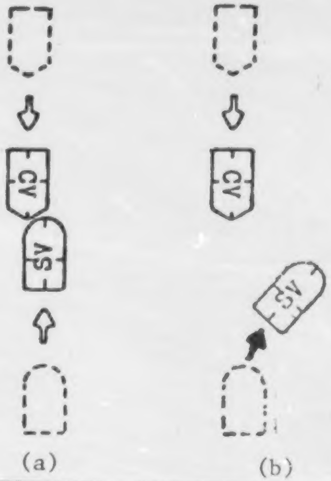
pared C. R. Hatterick	Approved By:	Page 6-19

(1) MODULE NO: 6	(2) MODULE TITLE: Collision Avoidance; Avoid head-on collision with oncoming vehicle.

Figure 6.1: Oncoming vehicle threat to left front quarter of subject's vehicle; No obstructions.

(a) No avoidance response.

(b) Best chance: Brake and steer right.

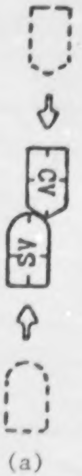


(a) (b)

Figure 6.2: Oncoming vehicle threat to right front quarter of subject's vehicle; No obstructions.

(a) No avoidance response.

(b) Best chance: Brake and steer left.

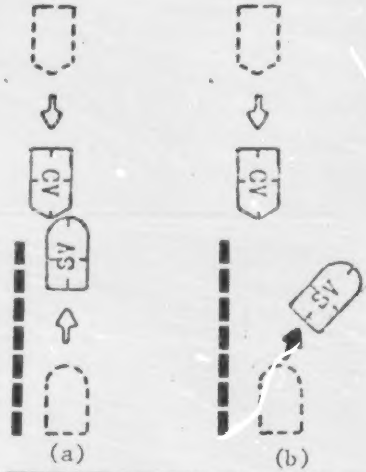


(a)

Figure 6.3: Oncoming vehicle threat to left front quarter of subject's vehicle; Left lane obstructed.

(a) No avoidance response.

(b) Best chance: Brake and steer right.

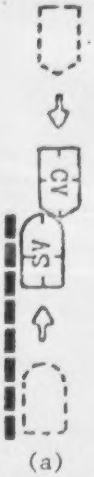


(a) (b)

Figure 6.4: Oncoming vehicle threat to right front quarter of subject's vehicle; Left lane obstructed.

(a) No avoidance response.

(b) Best chance: Brake and steer right.



(a)

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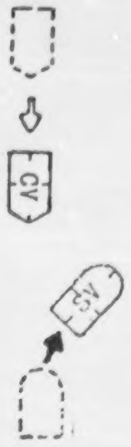
ollision Avoidance; Avoid head-on collision with oncoming vehicle.

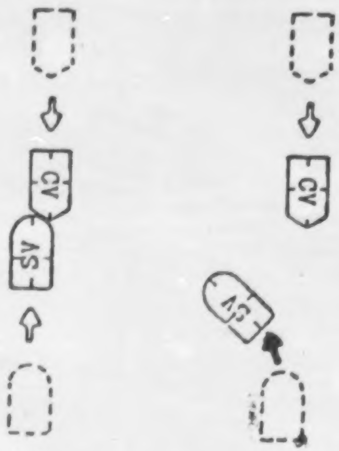


(b)

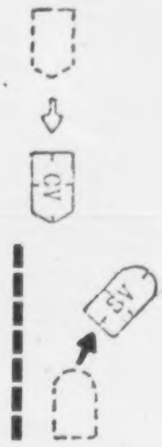
Figure 6.2: Oncoming vehicle threat to right front quarter of subject's vehicle; No obstructions.

(a) No avoidance response.

(b) Best chance: Brake and steer left.



(a) (b)

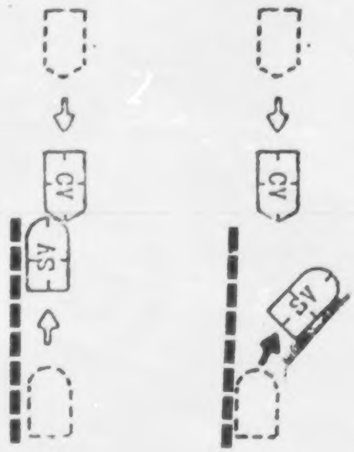


(b)

Figure 6.4: Oncoming vehicle threat to right front quarter of subject's vehicle; Left lane obstructed.

(a) No avoidance response.

(b) Best chance: Brake and steer right.



(a) (b)

① MODULE NO: 6	② MODULE TITLE: Collision Avoidance; Avoid head-on collision with oncoming vehicle.

Figure 6.5: Oncoming vehicle threat to left front quarter of subject's vehicle; Right lane obstructed.

(a) No avoidance response.

(b) Best chance: Brake and steer left.

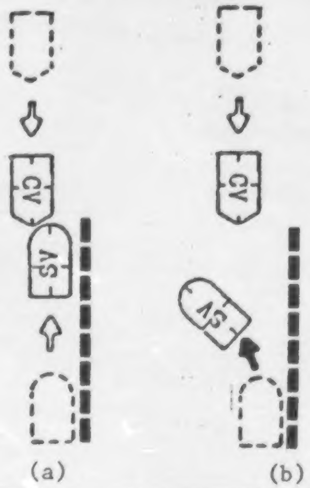


Figure 6.6: Oncoming vehicle threat to right front quarter of subject's vehicle; Right lane obstructed.

(a) No avoidance response.

(b) Best chance: Brake and steer left.

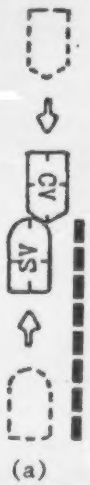


Figure 6.7: Oncoming vehicle threat to left front quarter of subject's vehicle; Left and right lanes obstructed.

(a) No avoidance response.

(b) Best chance: Brake straight ahead.

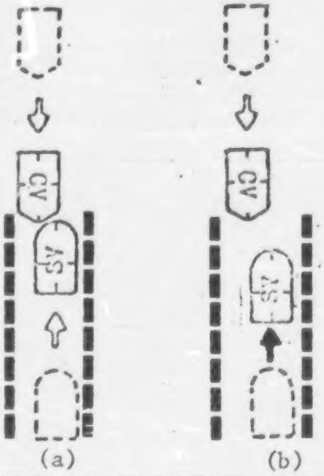
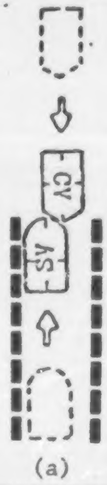


Figure 6.8: Oncoming vehicle threat to right front quarter of subject's vehicle; Left and right lanes obstructed.

(a) No avoidance response.

(b) Best chance: Brake straight ahead.



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ollision Avoidance; Avoid head-on collision with oncoming vehicle.

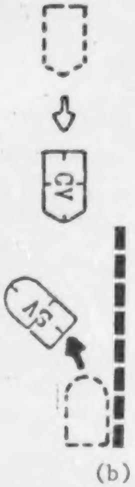
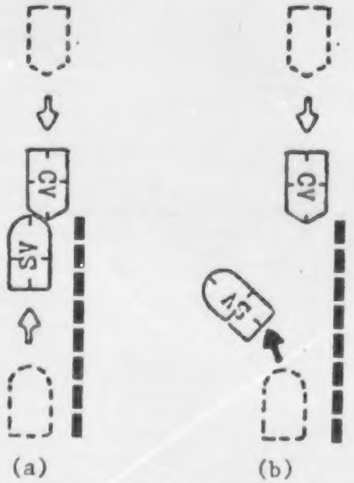


Figure 6.6: Oncoming vehicle threat to right front quarter of subject's vehicle; Right lane obstructed.

(a) No avoidance response.

(b) Best chance: Brake and steer left.



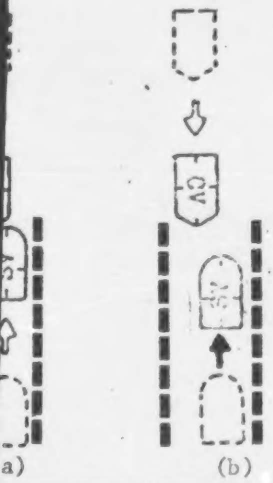


Figure 6.8: Oncoming vehicle threat to right front quarter of subject's vehicle; Left and right lanes obstructed.

(a) No avoidance response.

(b) Best chance: Brake straight ahead.

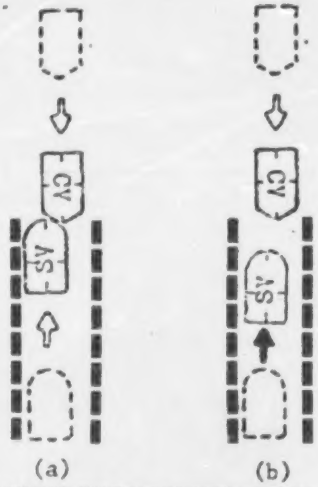


Table 6-1: TRAINING AND TESTING MATERIALS, EQUIPMENT, FACILITIES AND STAFF for MODULE #6 , Collision Avoidance, Oncoming Vehicle Threat

REQUIREMENT			USE	SUBMODULE																		NOTE
CODE		TITLE		A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	
0001	M	Course Summary	*	X																		
			#	X																		
0002	M	Module Summary, Module # 6	*	O	X							X										
			#	O	X							X										
0003	M	Course Schedule	*	O																		
			#	O																		
0004	M	Student Schedule Card	*	O	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
0005	M	Student Master Schedule	#	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	
0006	M	Range Layout Diagrams	*									O	O	X		O	X		O	X		
			#									O	X	X		X	X		O	X		
0008	M	BMS Instructions	*		O	X			X													
			#		X																	
0009	M	Range Instructions/ Safety	*									O	X	X		X	X		X	X		
			#									O	X	X		X	X		X	X		
0010	M	Equipment/Materials Checklist	#	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	
0012	M	Risk/Waiver Forms	#	O	X	X	X	X	X	X	X	O	X	X	X	X	X	X	X	X	X	
0013	M	Parental Consent Forms	#	O	X	X	X	X	X	X	X	O	X	X	X	X	X	X	X	X	X	4
0014	M	Instruction Procedure, Submodule	#	O	O	O	X	X	O	X	X	O	X	X	X	X	X	X	O	X	X	
0015	M	Content Material, Submodule	#	O	O	O	X	O	O	X	O	O	O	X	O	O	X	O	O	X	O	
0019	E	Movie Projector, 8mm	#	O																		3
0020	P	Instructor, Classroom(I)	@	O	O	O	O	O	O	O	O											
0021	P	Instructor,Classroom(II)	@	O	O	O	O		O	O												
0022	E	Bimodal Simulator (BMS)	@		O	O	O		O	O												
0023	M	Maneuvers List,Submodule	*	O	O	O			O			X	X			X			O			
			#	O	O	O			O			X	X			X			O			

See page B-12 of specification for explanation of symbols.

Table 6-1: TRAINING AND TESTING MATERIALS, EQUIPMENT, FACILITIES AND STAFF for MODULE #6 , Collision Avoidance, Oncoming Vehicle Threat

REQUIREMENT			USE	SUBMODULE																		NOTE
CODE		TITLE		A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	
0024	M	Maneuvers Description/ Illustration	*	O	O	O	X	X	O	X	X	O	O	X	X	O	X	X	O	X	X	
			#	O	X	X			X			X	X			X			O			
0025	M	Maneuvers Procedures	*	O	O	O			O			O	O			O			O			
			#	O	O	O			O			O	O	X		O	X		O	X		
0027	E	Screen, projection	#	O																		
0030	E	Projector, Movie, 16mm	@	O																		3
0032	M	Attendance Record	#	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	
0033	M	Student Performance Checklist	+			O	O		O	O			O	O		O	O			O		
			#					O			O				O			O			O	
0034	M	Video Tapes (Records)	#					O			O				O			O			O	
0035	P	Range Operations Coordinator	@									O	O	O		O	O			O		
0036	P	Instructor, Range (I)	@									O	O	O	O	O	O	O	O	O	O	
0037	P	Instructor, Range (II)	@									O	O	O		O	O			O		1
0038	F	Range, Auto Driving	@									O	O	O		O	O			O		
0039	E	Auto, Driver Training	@									O	O	O		O	O			O		1
0040	F	Classroom (I)	@	O																		2
0041	F	Classroom (II)	@		O	O	O	O	O	O	O				O			O	O		O	2
0042	E	Range marker cones	@									O	O	O		O	O			O		
0043	E	Range signal flags	@									O	O	O		O	O			O		
0044	M	Range marker stripes	@									O	O	O		O	O			O		
0045	E	Walkie-Talkies	@									O	O	O		O	O			O		
0046	E	Loudspeaker	@									O	O	O		O	O			O		
0047	E	First Aid Kit	@									X	X	X	X	X	X	X	X	X	X	
0048	E	Video Camera	+			O	O		O	O			O	O		O	O			O		
			@									O		O			O			O		

Table 6-1: TRAINING AND TESTING MATERIALS, EQUIPMENT, FACILITIES AND STAFF for MODULE # 6, Collision Avoidance, Oncoming Vehicle Threat

REQUIREMENT			USE	SUBMODULE																		NOTE
CODE		TITLE		A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	
0049	E	Video Recorder/Player	+			O	O		O	O			O	O		O	O			O		
			@					O			O			O			O			O		
0050	E	Video Monitor (I)	+			O	O	X	O	O	X		O	O	X	O	O	X		O	X	
0051	E	Video Monitor II	@		O	O	O	O	O	O	O											
0052	E	Crash Helmets	*									O	O	O		O	O			O		
			#									O	O	O		O	O			O		
0053	M	Range Operations Checklist	@									O	O	O		O	O			O		
0054	P	Range Crew	@									O	O	O		O	O			O		
0055	E	Range Support Vehicle	@									O	O	O		O	O			O		
0056	M	Maneuver Sequence List	*	O																		
			#	O			O			O				O			O			O		
0061	M	Simulator Film	#		O	O	O		O	O												
0062	M	Conflict Situation Movie	#	O																		
0063	M	Conflict Presentation Schedule	#				O			O		X	O	O		O	O			O		
0064	M	Conflict Situation Diagrams	*	O	X	X		X	X		X	X			X			X			X	
			#	O	X	X	X	X	X	X	X	X			X			X			X	
0065	E	Surrogate Vehicle	@									O	O	O		O	O			O		1
0066	E	Controller, Surrogate Vehicle	@									O										
			#										O	O		O	O			O		1
0067	E	Emergency Equipment	@									X	X	X		X	X			X		

NOTES: (1) Two are required.

(2) Choice of classroom based on recommended class size.

(3) Choice of projector depends on type of movie film used.

(4) If appropriate.

SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 6	② MODULE TITLE: Collision Avoidance, Avoid Head-on collision with oncoming vehicle.

Table 6-2: Obstruction variables and best-chance avoidance maneuvers for oncoming vehicle threat confl

CONFLICT VARIABLES	KEY	MANEUVER ALTERNATIVES BY OBSTRUCTION VARIABLES			
		NO OBSTRUCTIONS	LEFT LANE OBSTRUCTED	RIGHT LANE OBSTRUCTED	LEFT AND RIGHT LANES OBSTRUCTED
Oncoming vehicle closing; will strike subject vehicle at left front quarter (Condition #1).	BEST CHANCE MANEUVER	Brake and steer right	Brake and steer right	Brake and steer left	Brake straigh ahead
	RESULTANT	Avoidance	Avoidance	Avoidance(1)	Severity reduction
	ILLUSTRATION	FIG. 6.1	FIG. 6.3	FIG. 6.5	FIG. 6.7
Oncoming vehicle closing; will strike subject vehicle at right front quarter (Condition #2).	BEST CHANCE MANEUVER	Brake and steer left	Brake and steer right	Brake and steer left	Brake straigh ahead
	RESULTANT	Avoidance	Avoidance(1)	Avoidance	Severity reduction
	ILLUSTRATION	FIG. 6.2	FIG. 6.4	FIG. 6.6	FIG. 6.8
	BEST CHANCE MANEUVER				
	RESULTANT				
	ILLUSTRATION	FIG.	FIG.	FIG.	FIG.
	BEST CHANCE MANEUVER				
	RESULTANT				
	ILLUSTRATION	FIG.	FIG.	FIG.	FIG.

NOTES: (1) Less likely to achieve complete collision avoidance due to necessity of crossing path of CV.
(2) Not applicable, since the conflict vehicle is the primary straight-ahead obstruction.

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ENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

idance, Avoid Head-on collision with oncoming vehicle.
nce avoidance maneuvers for oncoming vehicle threat conflict.

MANEUVER ALTERNATIVES BY OBSTRUCTION VARIABLES

NO TRUCTIONS	LEFT LANE OBSTRUCTED	RIGHT LANE OBSTRUCTED	LEFT AND RIGHT LANES OBSTRUCTED	STRAIGHT AHEAD OBSTRUCTED (2)
e and steer t	Brake and steer right	Brake and steer left	Brake straight ahead	N/A
dance	Avoidance	Avoidance (1)	Severity reduction	
.1	FIG. 6.3	FIG. 6.5	FIG. 6.7	FIG.
e and r left	Brake and steer right	Brake and steer left	Brake straight ahead	N/A
ance	Avoidance (1)	Avoidance	Severity reduction	
.2	FIG. 6.4	FIG. 6.6	FIG. 6.8	FIG.
	FIG.	FIG.	FIG.	FIG.
	FIG.	FIG.	FIG.	FIG.

sion avoidance due to necessity of crossing path of CV.
hicle is the primary straight-ahead obstruction.

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MODULE NO: 7

COMPREHENSIVE COLLISION AVOIDANCE TEST

SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

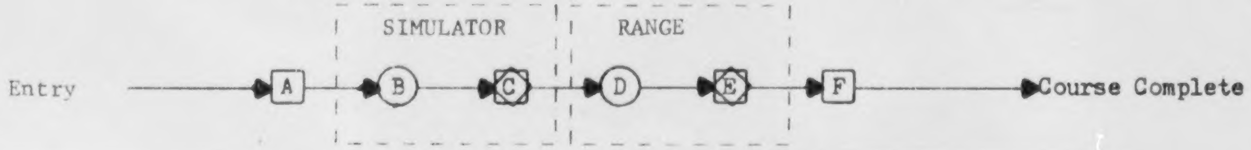
(1) MODULE NO: 7	(2) MODULE TITLE: Comprehensive Collision Avoidance Test

(3) PURPOSE OF MODULE: To measure the ability of students to retain and integrate the knowledge and sk in Modules #1, 2, 3, 4, 5 and 6.

(4) STUDENT ENTRANCE PREREQUISITES: Completion of Module #1; Completion of at least two of the Collision Modules (#2, 3, 4, 5, and 6); A valid automobile operator's license.

(5) APPLICABLE INSTRUCTION TECHNIQUES: Bimodal Simulator; Advanced Driving Range.

(6) INSTRUCTIONAL APPROACH: Testing will be accomplished by having students drive their vehicles throu conflicts in which all of the conflicts included in earlier instruction will confront them, in a rando presentation, and varying levels of potential severity. The testing will be accomplished in six submod follows:



A: Pre-test Briefing
B: Bimodal Simulator Comprehensive Test(1)
C: Simulator Test Debriefing
D: Advanced Driving Range Comprehensive Test
E: Range Test Debriefing
F: Post-course Student Survey

☐ = Lecture
◇ = Participation and Practice
○ = Proficiency T

Note: (1) Simulator will operate in plan view mode only.

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OR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

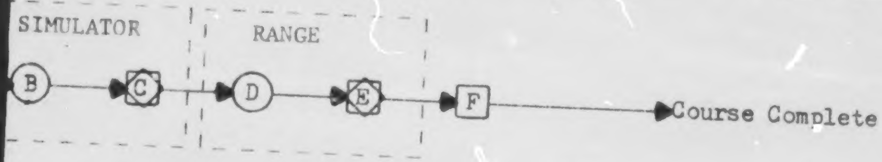
ollision Avoidance Test

ability of students to retain and integrate the knowledge and skills learned
2, 3, 4, 5 and 6.

pletion of Module #1; Completion of at least two of the Collision Avoidance
dules (#2, 3, 4, 5, and 6); A valid automobile operator's license.

Bimodal Simulator; Advanced Driving Range.

ill be accomplished by having students drive their vehicles through a series of
ts included in earlier instruction will confront them, in a randomized order of
otential severity. The testing will be accomplished in six submodules, as



Comprehensive Test(1)
briefing
Range Comprehensive Test
fing
nt Survey

□ = **Lecture**
◇ = **Participation and Practice**
○ = **Proficiency Test**

plan view mode only.

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SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 7	② MODULE TITLE: Comprehensive Collision Avoidance Test
⑦ SUBMODULE NO: 7.A	⑧ SUBMODULE TITLE: Pre-test Briefing, Bimodal Simulator and Advanced Driving Range; testing of all conflict situations.

⑨ SUBMODULE OBJECTIVES:

(1) To prepare the student for conduct of the integrated testing submodule by describing the scope of the test, reviewing the characteristics of the included conflict situations, and describing the maneuvers most likely to be successful.

(2) To assure that the student comprehends the need to select the most appropriate course of evasive action based on the specific characteristics of the conflict situations confronting him.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

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⑪ STUDENT MATERIALS: See Table 7-1	⑫ INSTRUCTOR MATERIALS: See Table 7-1	⑬ EVALUATION MATERIALS: See Table 7-1	⑭ SUPPORT See Tabl

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N FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

Comprehensive Collision Avoidance Test

: Pre-test Briefing, Bimodal Simulator and Advanced Driving Range; Comprehensive testing of all conflict situations.

t of the integrated
he scope of the test,
the included conflict
neuvers most likely

nends the need to
e of evasive action
tics of the conflict

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

TRUCTOR MATERIALS:

e Table 7-1

⑬ EVALUATION MATERIALS:

See Table 7-1

⑭ SUPPORT REQUIREMENTS:

See Table 7-1

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SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 7	② MODULE TITLE: Comprehensive Collision Avoidance Test
⑦ SUBMODULE NO: 7.B	⑧ SUBMODULE TITLE: Comprehensive Test, Bimodal Simulator; Comprehensive testing of situations.

⑨ SUBMODULE OBJECTIVES:

(1) To ascertain that each student has learned to recognize the precursor conditions of each conflict situation as soon as they appear;

(2) To determine that the student has learned to select the most feasible alternative available to either avoid, or reduce the effects of, a collision resulting from any of the conflict situations;

(3) To determine that each student has learned to effectively implement the avoidance maneuver selected in each of the conflict situations;

(4) To determine whether the student maintains competency in recognizing the type of conflict and selecting and implementing the "best chance" avoidance maneuver with no advance cues as to the type of conflict, and with serial multiple conflict situations.

(5) To determine the extent of performance degradation as a result of elapsed time, from the initially presented modules through the most recently presented modules.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Bimodal simulator operates in plan vi
during this test in order to eliminat
to the type of conflict about to be f

⑪ STUDENT MATERIALS:	⑫ INSTRUCTOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPORT
See Table 7-1	See Table 7-1	See Table 7-1	See Ta

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FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

omprehensive Collision Avoidance Test

Comprehensive Test, Bimodal Simulator; Comprehensive testing of all conflict situations.

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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Bimodal simulator operates in plan view mode only during this test in order to eliminate advance cues to the type of conflict about to be faced.

RUCTOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPORT REQUIREMENTS:
Table 7-1	See Table 7-1	See Table 7-1

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SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 7	② MODULE TITLE: Comprehensive Collision Avoidance Test
⑦ SUBMODULE NO: 7.C	⑧ SUBMODULE TITLE: Bimodal Simulator Comprehensive Test Debriefing

⑨ SUBMODULE OBJECTIVES:

(1) To provide to the student an immediate assessment of the level of performance achieved during the test.

(2) To provide to the student specific comments regarding deficiencies in performance and the corrective action required, and instances of superior performance.

(3) To gain from the student an immediate appraisal of difficulties encountered and reactions to the test.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

⑪ STUDENT MATERIALS: See Table 7-1	⑫ INSTRUCTOR MATERIALS: See Table 7-1	⑬ EVALUATION MATERIALS: See Table 7-1	⑭ SUPPORT See Table

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R ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

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nodal Simulator Comprehensive Test Debriefing

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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

TOR MATERIALS:

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⑬ EVALUATION MATERIALS:

See Table 7-1

⑭ SUPPORT REQUIREMENTS:

See Table 7-1

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SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 7

② MODULE TITLE: Comprehensive Collision Avoidance Test

⑦ SUBMODULE NO: 7.D

⑧ SUBMODULE TITLE: Comprehensive Test, Advanced Driving Range; Comprehensive testin conflict situations.

⑨ SUBMODULE OBJECTIVES:

(1) To ascertain that each student has learned to recognize the precursor conditions of each conflict situation as soon as they appear;

(2) To determine that the student has learned to select the most feasible alternative available to either avoid, or reduce the effects of, a collision resulting from any of the conflict situations;

(3) To determine that each student has learned to effectively implement the avoidance maneuver selected in each of the conflict situations;

(4) To determine whether the student maintains competency in recognizing the type of conflict and selecting and implementing the "best chance" avoidance maneuver with no advance cues as to the type of conflict, and with serial multiple conflict situations.

(5) To determine the extent of performance degradation as a result of elapsed time, from the initially presented modules through the most recently presented modules.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Only student participants and requir staff will be permitted on the range submodule.

(2) All range safety equipment and proce verified prior to initiating student

(3) Range Safety Monitor must be on duty during the use of the range.

⑪ STUDENT MATERIALS:	⑫ INSTRUCTOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPORT
See Table 7-1	See Table 7-1	See Table 7-1	See Tab

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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Only student participants and required instructor staff will be permitted on the range during this submodule.

(2) All range safety equipment and procedures will be verified prior to initiating student test sessions.

(3) Range Safety Monitor must be on duty at all times during the use of the range.

MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPORT REQUIREMENTS:
7-1	See Table 7-1	See Table 7-1

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SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 7	② MODULE TITLE: Comprehensive Collision Avoidance Test
⑦ SUBMODULE NO: 7.E	⑧ SUBMODULE TITLE: Advanced Driving Range Comprehensive Test Debriefing

⑨ SUBMODULE OBJECTIVES:

(1) To provide to the student an immediate assessment of the level of performance achieved during the test.

(2) To provide to the student specific comments regarding deficiencies in performance and the corrective action required, and instances of superior performance.

(3) To gain from the student an immediate appraisal of difficulties encountered and reactions to the test.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

⑪ STUDENT MATERIALS:	⑫ INSTRUCTOR MATERIALS:	⑬ EVALUATION MATERIALS:	⑭ SUPPORT
See Table 7-1	See Table 7-1	See Table 7-1	See Tabl

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CCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

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ced Driving Range Comprehensive Test Debriefing

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the test.

⑪ SPECIAL PRECAUTIONS AND PROCEDURES:

MATERIALS:

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⑬ EVALUATION MATERIALS:

See Table 7-1

⑭ SUPPORT REQUIREMENTS:

See Table 7-1

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SPECIFICATION FOR ACCIDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

① MODULE NO: 7	② MODULE TITLE: Comprehensive Collision Avoidance Test
⑦ SUBMODULE NO: 7.F	⑧ SUBMODULE TITLE: Post-course student survey

⑨ SUBMODULE OBJECTIVES:

(1) To obtain the student's appraisal of any change in ability to recognize and avoid motor vehicle accidents as a result of taking and completing the course;

(2) To obtain the student's appraisal of whether the course would be helpful to the general driving population;

(3) To obtain the student's recommendations for changes and modifications to the course.

⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Research objective: To determine the st willingness to cooperate in a longitudi of accident avoidance.

⑪ STUDENT MATERIALS: See Table 7-1	⑫ INSTRUCTOR MATERIALS: See Table 7-1	⑬ EVALUATION MATERIALS: See Table 7-1	⑭ SUPPORT R See Tabl

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IDENT AVOIDANCE SKILL TRAINING AND PERFORMANCE TESTING

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⑩ SPECIAL PRECAUTIONS AND PROCEDURES:

(1) Research objective: To determine the student's willingness to cooperate in a longitudinal study of accident avoidance.

MATERIALS: 7-1	⑬ EVALUATION MATERIALS: See Table 7-1	⑭ SUPPORT REQUIREMENTS: See Table 7-1

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Table 7-1: TRAINING AND TESTING MATERIALS, EQUIPMENT, FACILITIES AND STAFF for MODULE # 7, Comprehensive Collision Avoidance Test.

REQUIREMENT			USE	SUBMODULE																		NOTE
CODE		TITLE		A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	
0001	M	Course Summary	*	X					X													
			#	X					X													
0002	M	Module Summary, Module # 7	*	O		X		X	X													
			#	O																		
0003	M	Course Schedule	*	O																		
			#	O																		
0004	M	Student Schedule Card	*	X	X	X	X	X	X													
0005	M	Student Master Schedule	#	O	O	O	O	O	X													
0006	M	Range Layout Diagrams	*	O			X	X	X													
			#	O			X	X	X													
0008	M	BMS Instructions	*	X					X													
			#	X					X													
0009	M	Range Instructions/ Safety	*	X			X		X													
			#	X			X		X													
0010	M	Equipment/Materials Checklist	#	O	O	O	O	O	O													
0012	M	Risk/Waiver Forms	#	X	X	X	X	X														
0013	M	Parental Consent Forms	#	X	X	X	X	X														3
0014	M	Instruction Procedure, Submodule	#	O	X	X	X	X	X													
0015	M	Content Material, Submodule	#	O	X	O	X	O														
0020	P	Instructor,Classroom(I)	@	O	O	O			O													
0021	P	Instructor,Classroom(II)	@	O	O				O													
0022	E	Bimodal Simulator(BMS)	@		O	X			X													
0023	M	Maneuvers List,Submodule	*	O					X													
			#	O	O	O	O	O	X													
0024	M	Maneuvers Description/ Illustration	*	O	X	X	X	X	X													
			#	O		X		X	X													

See page B-12 of specification for explanation of symbols.

Table 7-1 : TRAINING AND TESTING MATERIALS, EQUIPMENT, FACILITIES AND STAFF for MODULE #7 , Comprehensive Collision Avoidance Test

REQUIREMENT			USE	SUBMODULE																		NOTE
CODE		TITLE		A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	
0025	M	Maneuvers Procedures	*	O		X		X	X													
			#	O		X	X	X	X													
0032	M	Attendance Record	#	O	O	O	O	O	O													
0033	M	Student Performance Checklist	+		O		O															
			#			O		O	X													
0034	M	Video Tapes (Records)	#			O		O														
0035	P	Range Operations Coordinator	@				O															
0036	P	Instructor Range (I)	@	O			O	O	O													
0037	P	Instructor, Range (II)	@				O															1
0038	F	Range, Auto Driving	@				O															
0039	E	Auto, Driver Training	@				O															1
0040	F	Classroom (I)	@						O													2
0041	F	Classroom (II)	@	O	O	O		O	O													2
0042	E	Range marker cones	@				O															
0043	E	Range signal flags	@				O															
0044	M	Range marker stripes	@				O															
0045	E	Walkie-Talkies	@				O															
0046	E	Loudspeaker	@				O															
0047	E	First Aid Kit	@	X	X	X	X	X	X													
0048	E	Video Camera	+		O	O	O															
			@				O															
0049	E	Video Recorder/Player	+		O		O															
			@			O	O															
0050	E	Video Monitor (I)	+		O	X	O	X														
0051	E	Video Monitor II	@		O	O																

Table 7-1: TRAINING AND TESTING MATERIALS, EQUIPMENT, FACILITIES AND STAFF for MODULE # 7, Comprehensive Collision Avoidance Test

REQUIREMENT			USE	SUBMODULE																		NOTE
CODE		TITLE		A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	
0052	E	Crash Helmets	* # 				O O															
0053	M	Range Operations Checklist	@				O															
0054	P	Range Crew	@				O															
0055	E	Range Support Vehicle	@				O															
0056	M	Maneuvers Sequence List	#		O		O															
0061	M	Simulator Film	#		O																	
0063	M	Conflict Presentation Schedule	#		O		O															
0064	M	Conflict Situation Diagrams	* #	O 	 X	X X	 X	X X														
0065	E	Surrogate Vehicle	@				O															1
0066	E	Controller, Surrogate Vehicle	@				O															1
0067	E	Emergency Equipment	@				X															
0068	M	Post-Course Student Survey Form	#						O													
0069	M	Registration Form, Longitudinal Study	# *						O O													

Notes: (1) Two are required.

(2) Choice of classroom based on recommended class size.

(3) If appropriate.

ACCIDENT AVOIDANCE SKILL TRAINING
AND PERFORMANCE TESTING

FINAL REPORT

APPENDIX C

BIMODAL SIMULATOR - DESCRIPTIVE MATERIALS

LIST OF MAJOR BIMODAL SIMULATOR COMPONENTS

The following listing of major components is keyed, by circled numbers (e.g., ⑨), to the appropriate parts in the photographs in this appendix and the figures in Section 3.3 of the report.

① Roadway Belt

② CCTV Camera (Panasonic, type WV-3082)

③ Experimentor Control Station

④ Driver's Vehicle (DV) Roadway Belt Velocity Drive Motor (Western Gear, type P5B24R3)

⑤ Driver's Vehicle (DV) Lateral Position Drive Motor (Heinz Mueller, type ES25827)

⑥ Driver's Vehicle (DV) Lateral Position Threaded Drive Shaft

⑦ Conflict Vehicle (CV) Transport Slide

⑧ Conflict Vehicle (CV)

⑨ Driver's Vehicle (DV)

⑩ Driver's Vehicle (DV) Turn Angle Position

- (10A) Motor (Oster, type 13R9101-01)
- (10B) Sensors

⑪ Driver Control Station (Doron, Model L-200)

⑫ CRT Display (Panasonic, 9", type TR-910VN)

⑬ Conflict Vehicle (CV) Transverse Speed Control

⑭ Conflict Vehicle (CV) Transport Slide Drive Motor (Globe, type C5A1067)

⑮ Roadway Belt Centerline

⑯ Roadway Belt Primary Drive Pulley

⑰ Roadway Belt Secondary Drive Pulley

⑱ Driver's Vehicle (DV) Position Angle Effector Pulley

⑲ Driver's Vehicle (DV) Lateral Position Limit Switch

- (19A) Left side
- (19B) Right side

⑳ Conflict Vehicle (CV) Transport Slide Limit Switch

㉑ Conflict Vehicle (CV) Speed Set, fore and aft

㉒ Conflict Initiate Switch

㉓ Driver's Vehicle (DV) Steady State Speed Set

㉔ Driver Control Station Accelerator Override Switch

㉕ Video Tape Recorder (VTR) (Panasonic, type NV-3082)

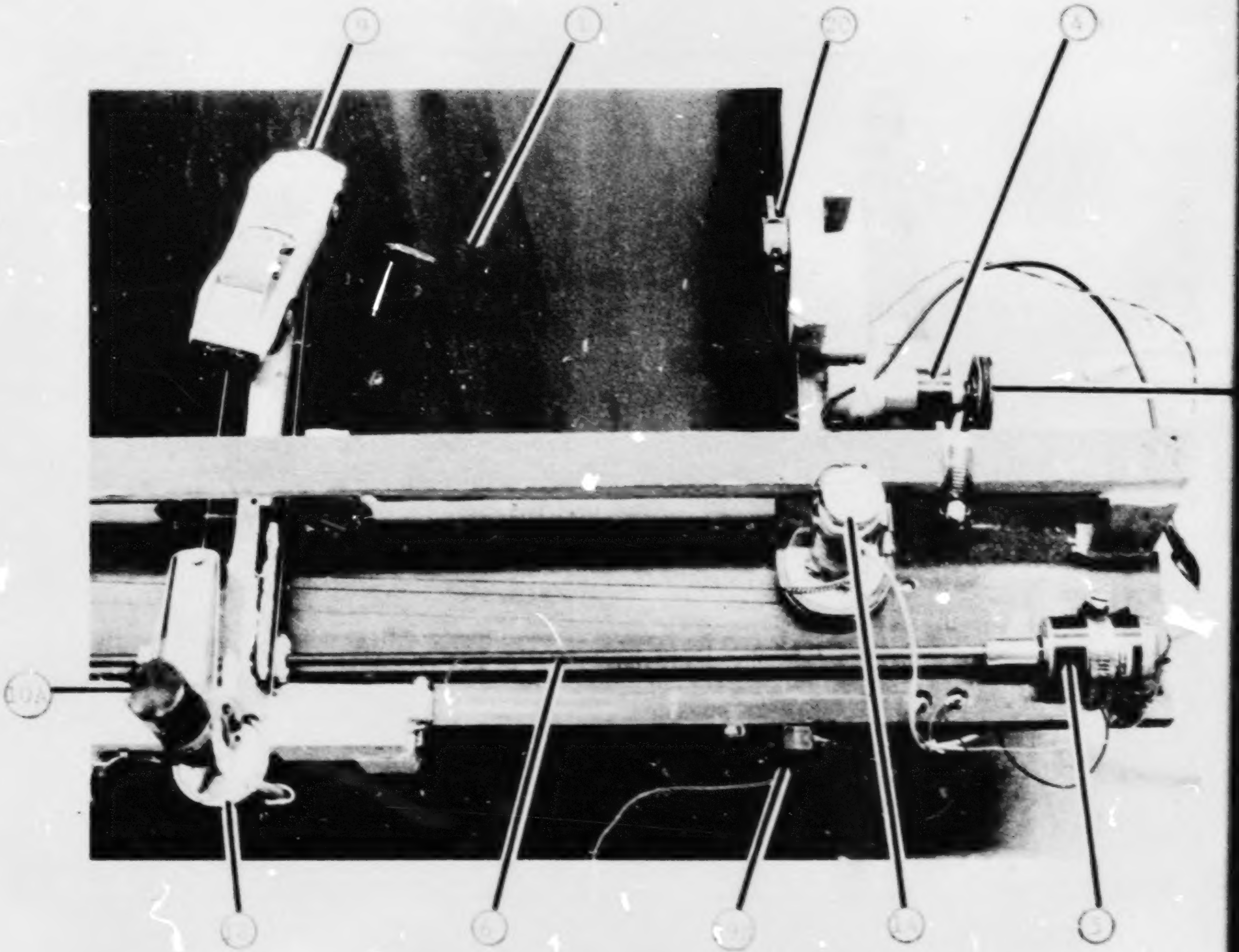
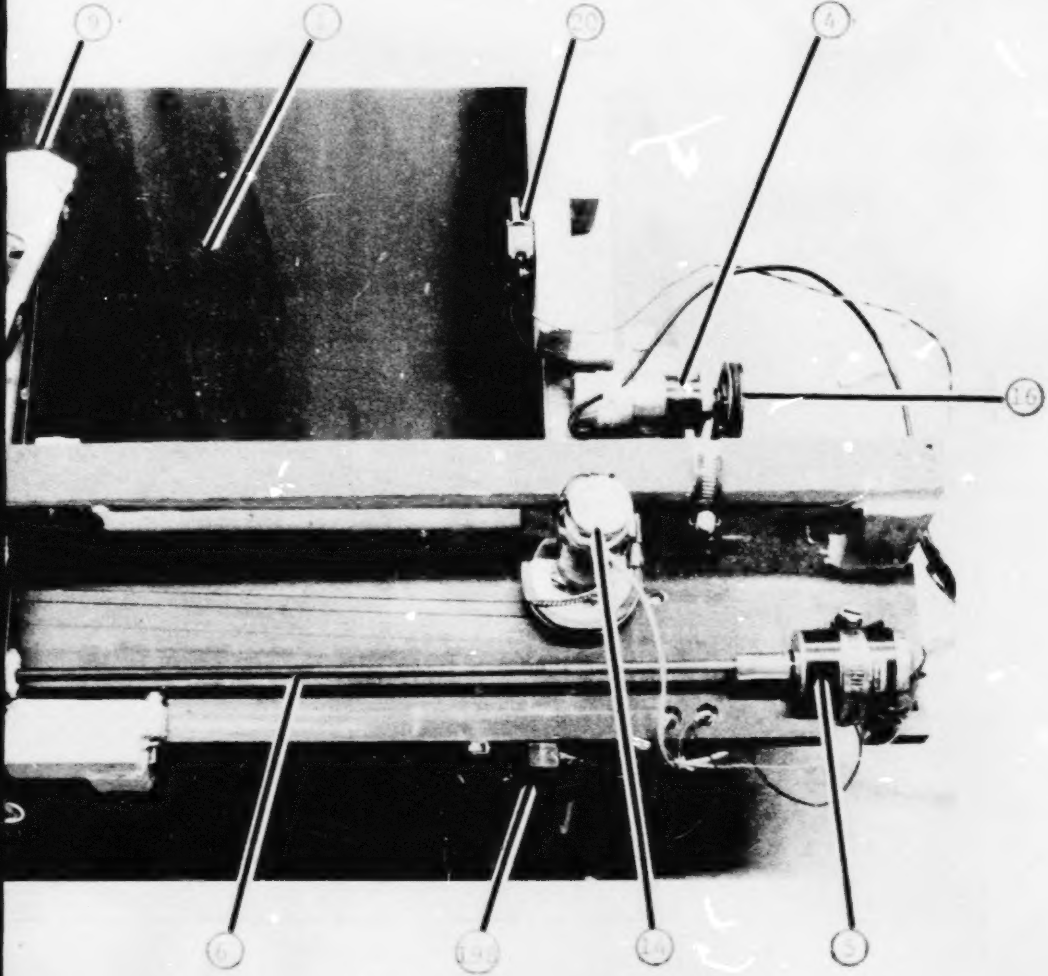


FIGURE C-1: DRIVER'S VEHICLE (DV) SPEED AND MANEUVERING MECHANISMS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C-1: DRIVER'S VEHICLE (DV) SPEED AND MANEUVERING MECHANISMS

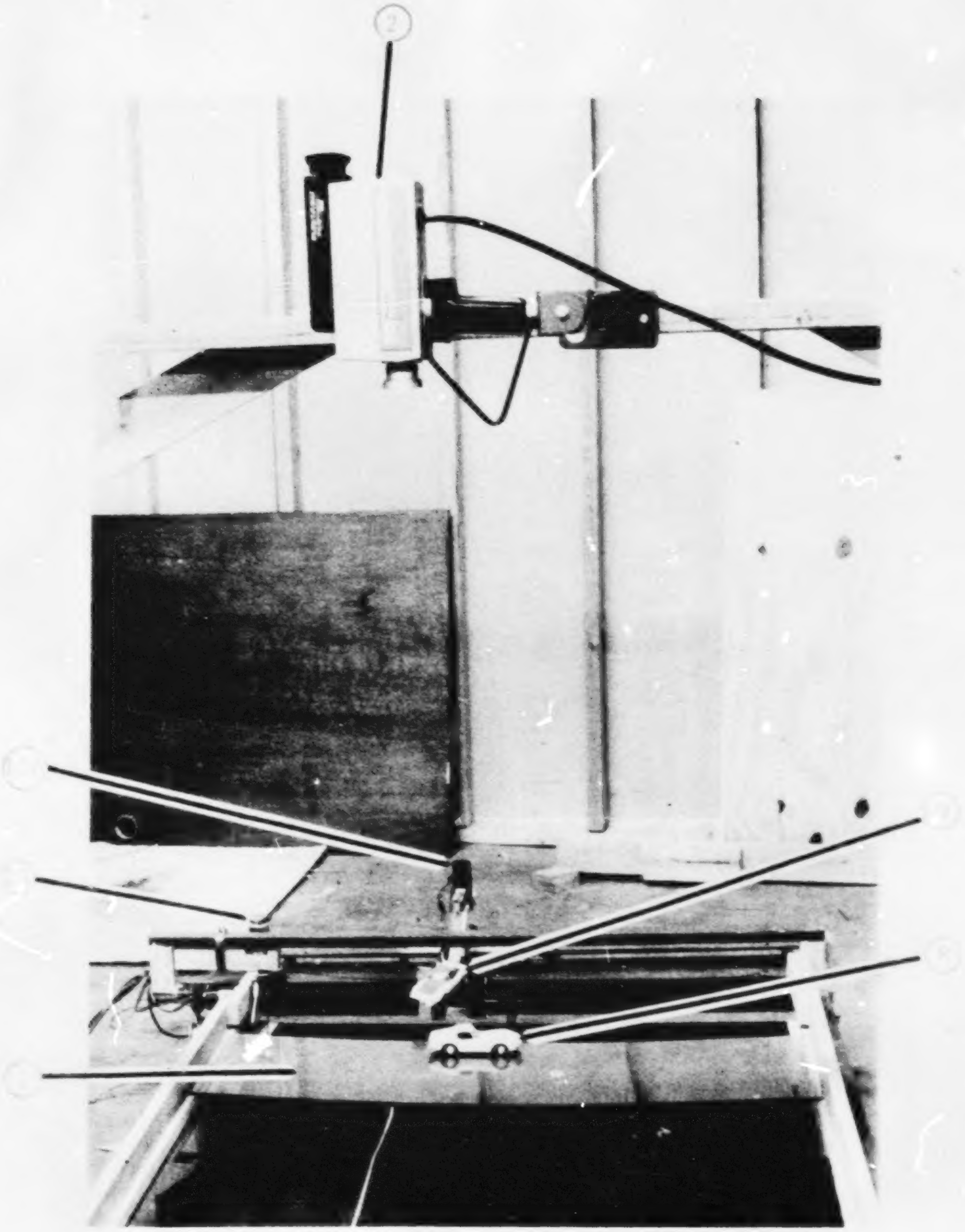


FIGURE C-2: CONFIGURATION FOR VIDEO DISPLAY OF INTERSECTING VEHICLE CONFLICT (AVOIDED)

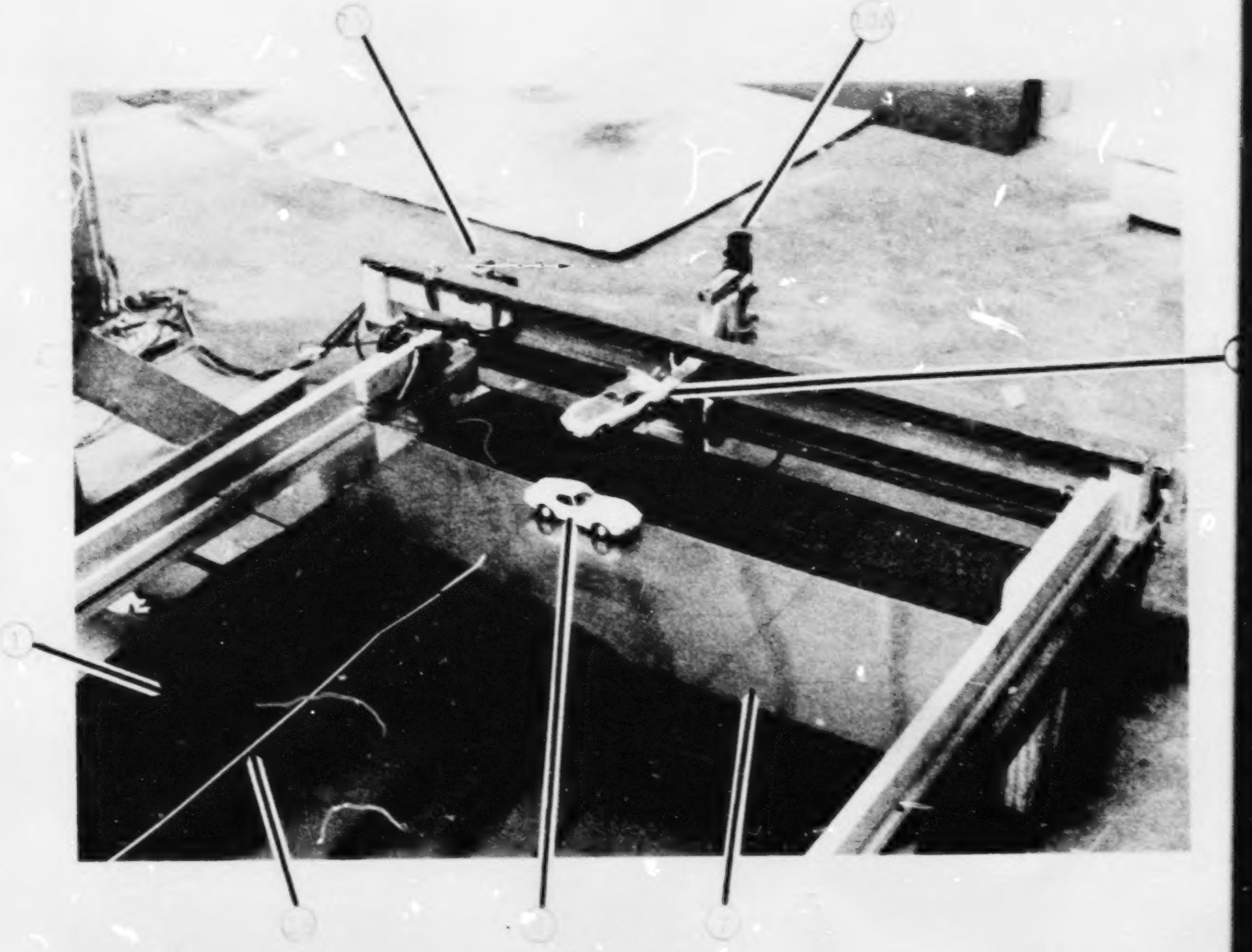
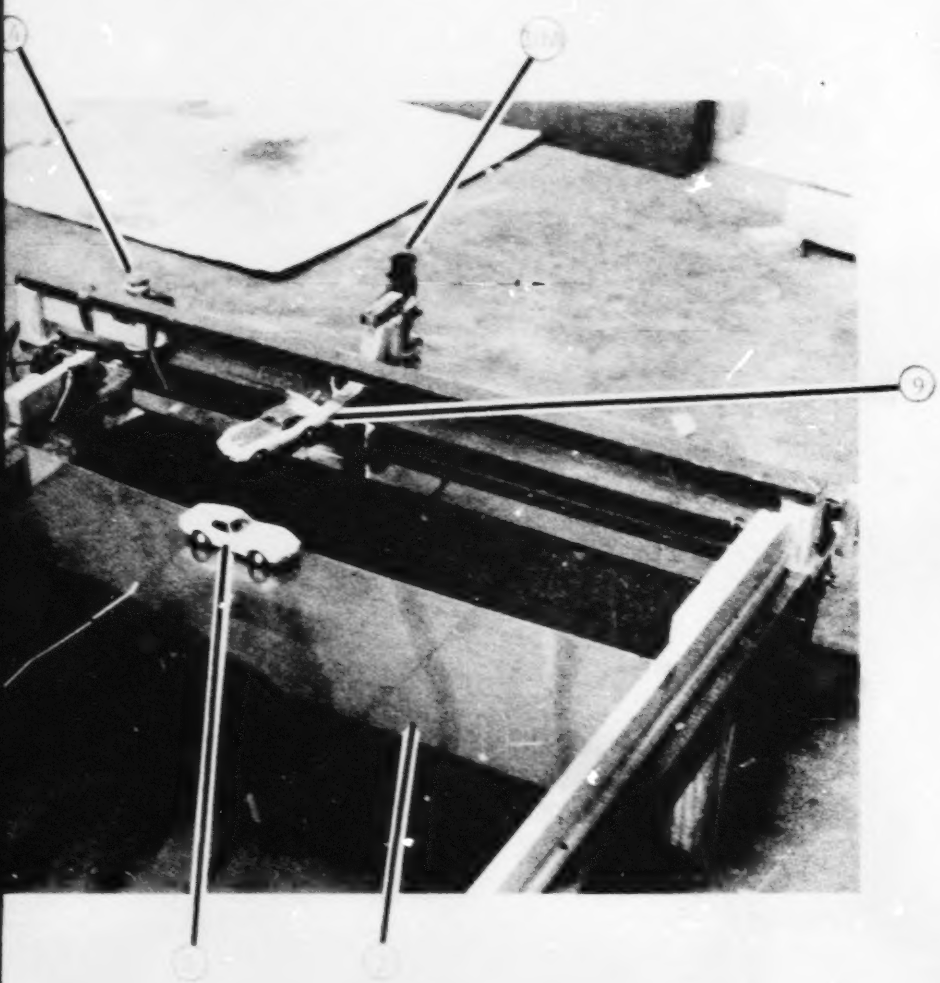


FIGURE C-3: INTERSECTING VEHICLE CONFLICT (AVOIDED) ON BIMODAL SIMULATOR PLAN VIEW GENERA



HICLE CONFLICT (AVOIDED) ON BIMODAL SIMULATOR PLAN VIEW GENERATOR

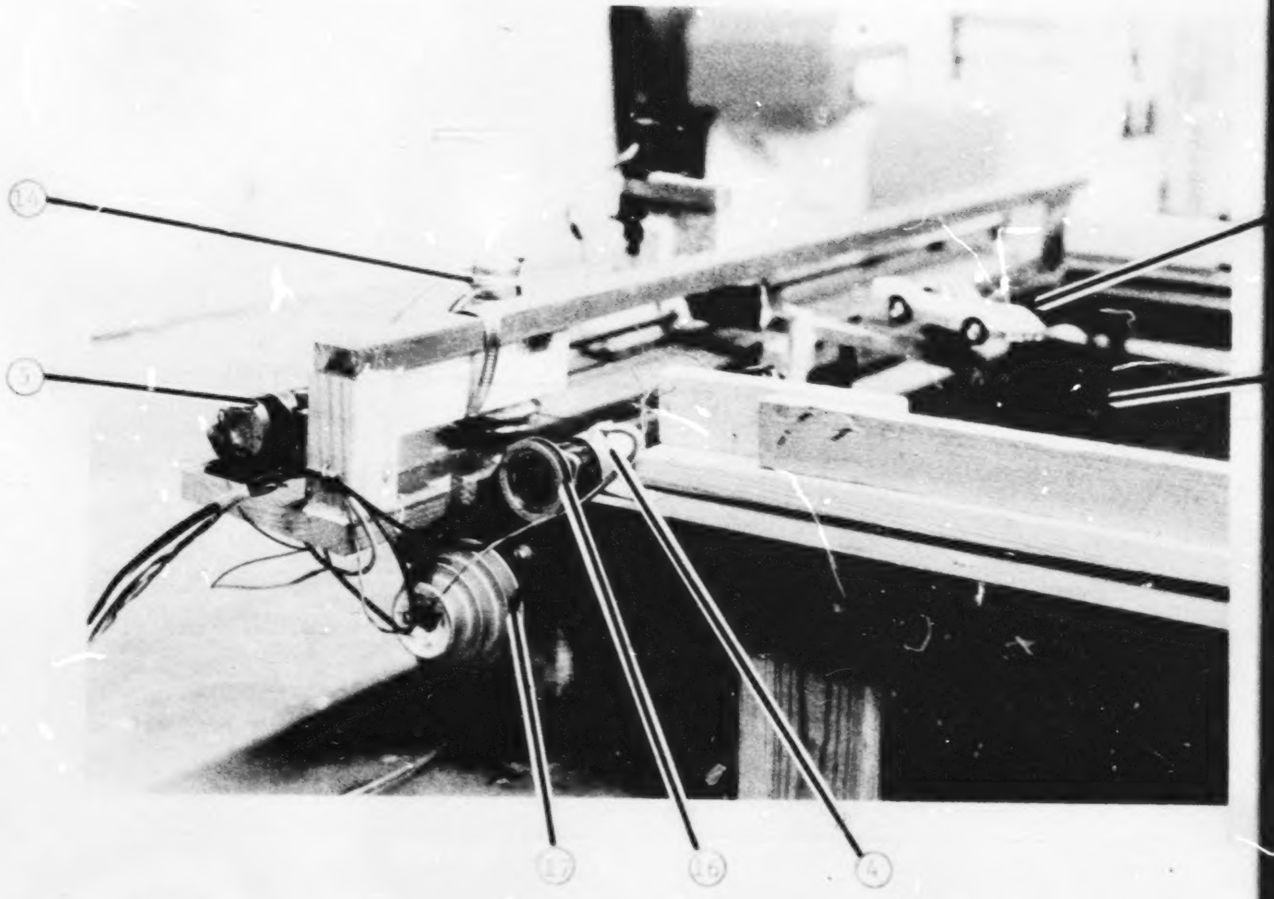
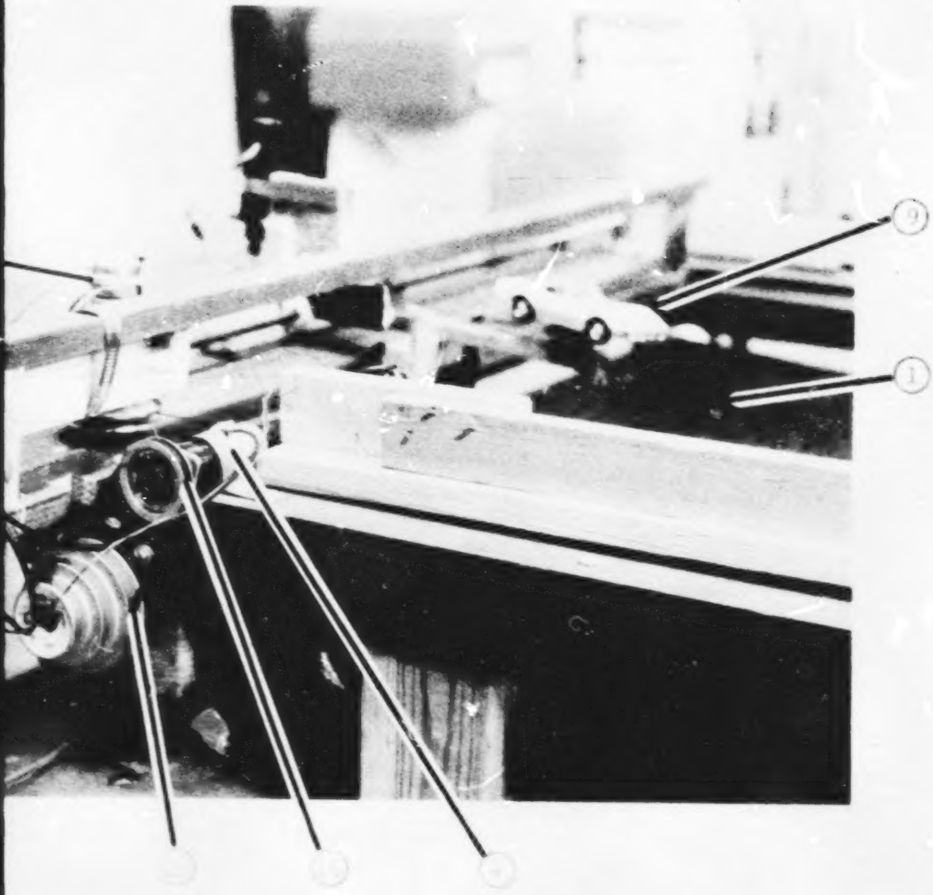
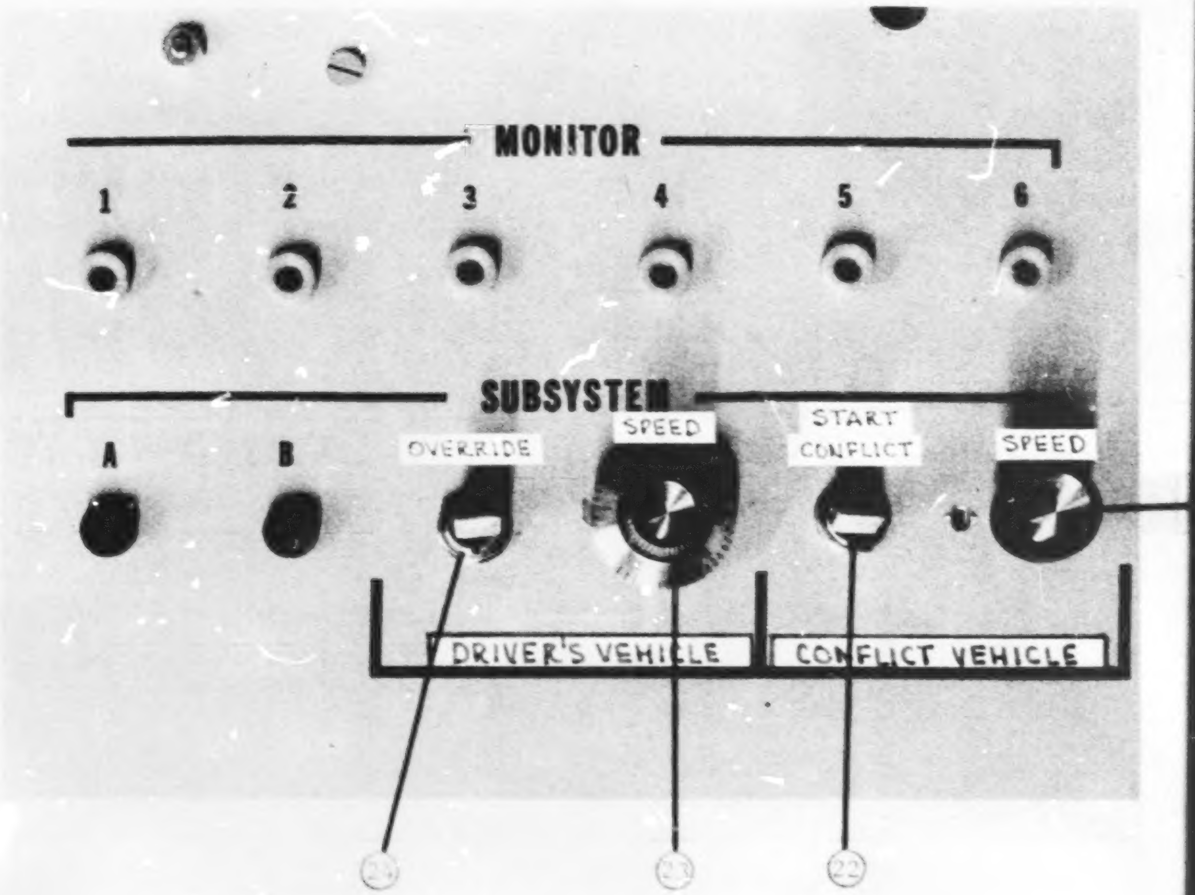


FIGURE C-4: SIDE VIEW OF SPEED AND POSITION CONTROL MECHANISMS



E VIEW OF SPEED AND POSITION CONTROL MECHANISMS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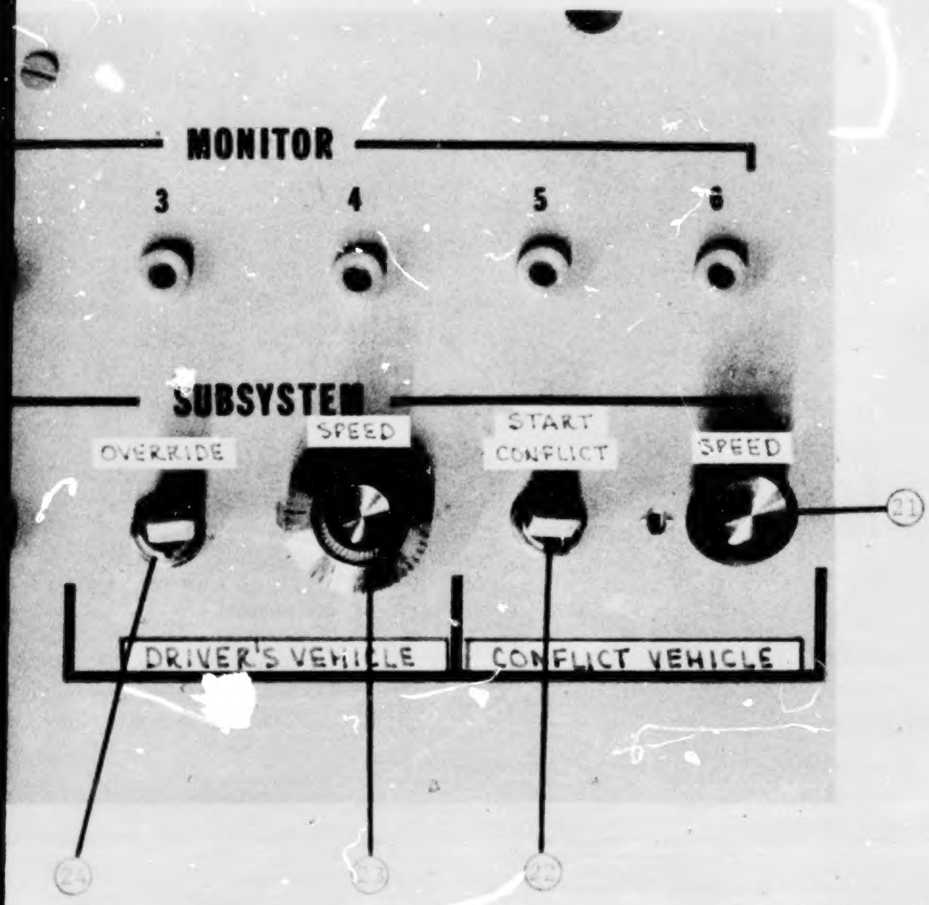
3
4
5
6
SUBSYSTEM
A
B
OVERRIDE
SPEED
START CONFLICT
SPEED
DRIVER'S VEHICLE
CONFLICT VEHICLE
㉔
㉓
㉒

FIGURE C-5: EXPERIMENTOR CONTROL PANEL USED FOR CONCEPT VERIFICATION


MONITOR
3
4
5
6
SUBSYSTEM
OVERRIDE
SPEED
START CONFLICT
SPEED
DRIVER'S VEHICLE
CONFLICT VEHICLE
21
24
23
22

RIMENTOR CONTROL PANEL USED FOR CONCEPT VERIFICATION

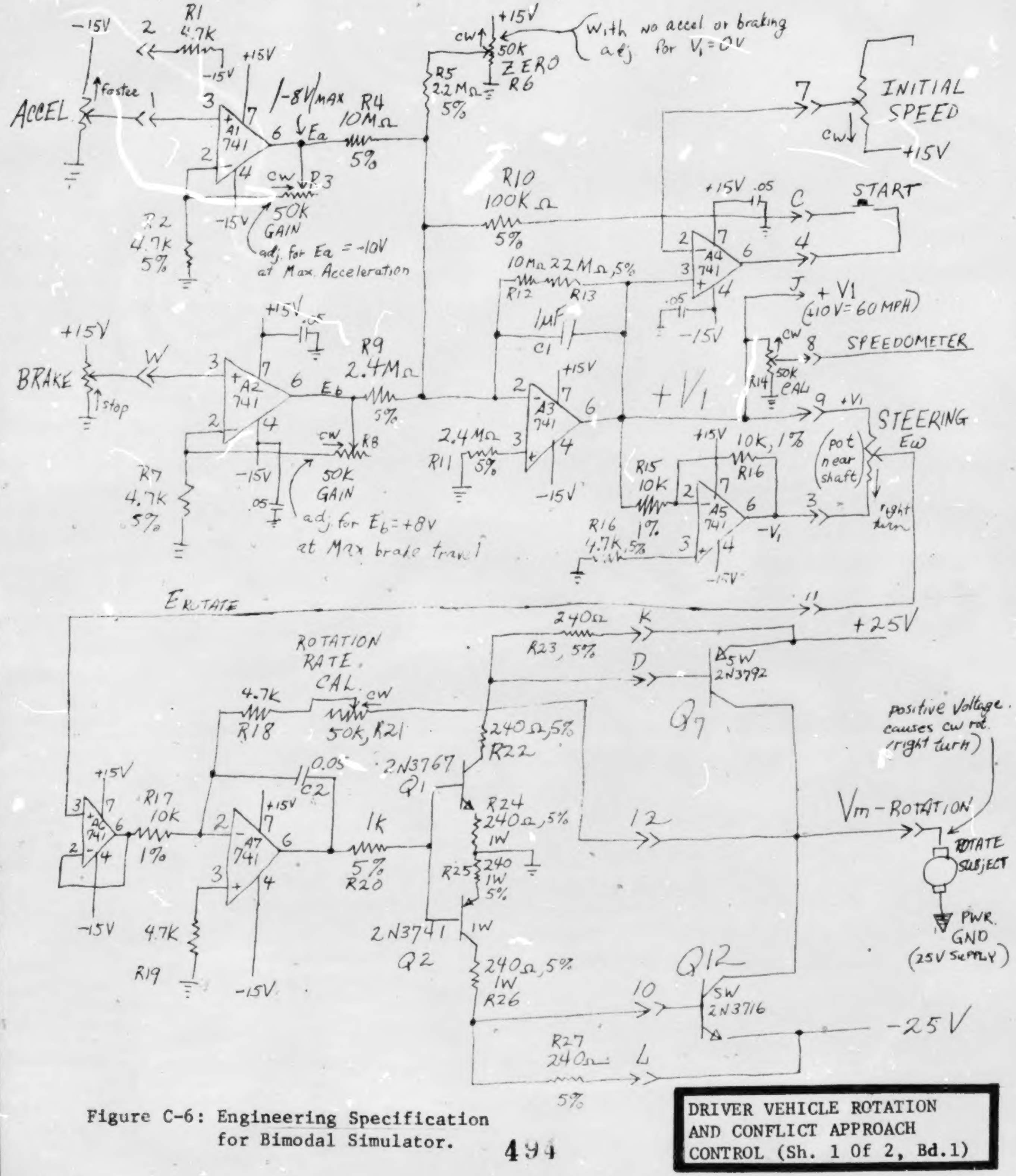
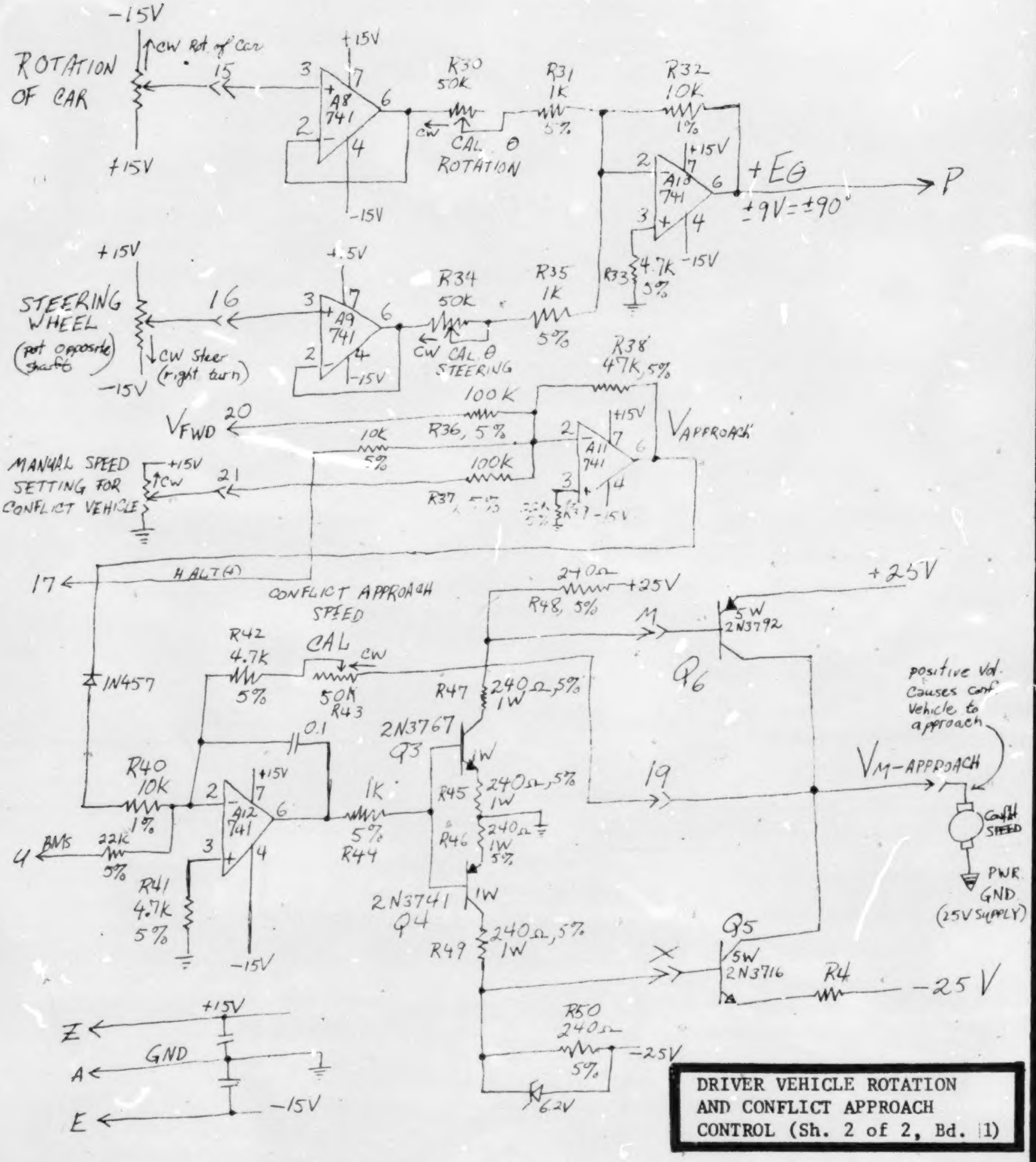

-15V
R1
4.7K
2
-15V
+15V
ACCEL
faster
1
3
A1
741
7
6
2
4
1-8V MAX
Ea
R4
10MΩ
5%
CW
R3
50K
GAIN
-15V
adj. for Ea = -10V at Max Acceleration
R2
4.7K
5%
+15V
CW
50K
ZERO
R6
R5
2.2MΩ
5%
With no accel or braking adj for V1 = 0V
7
INITIAL SPEED
CW
+15V
R10
100K Ω
5%
+15V
.05
C
START
2
7
A4
741
6
4
3
4
.05
-15V
10MΩ 2.2MΩ, 5%
R12
R13
1μF
C1
J
+V1
(+10V = 60 MPH)
CW
8
SPEEDOMETER
R14
50K
CAL
+15V
.05
R9
2.4MΩ
5%
+15V
BRAKE
stop
W
3
A2
741
7
6
Eb
2
4
CW
R8
50K
GAIN
-15V
.05
adj. for Eb = +8V at Max brake travel
R7
4.7K
5%
2
A3
741
7
6
3
4
+15V
-15V
2.4MΩ
R11
5%
+V1
9
+V1
STEERING
Eω
(pot near shaft)
right turn
+15V
10K, 1%
R16
R15
10K
1%
2
7
A5
741
6
-V1
3
3
4
R16
4.7K, 5%
-15V
E ROTATE
11
+25V
240Ω
K
R23, 5%
D
5W
2N3792
Q7
ROTATION RATE CAL.
4.7K
R18
CW
50K, R21
240Ω, 5%
R22
0.05
C2
2N3767
Q1
R24
240Ω, 5%
1W
240
1W
5%
R25
positive Voltage causes cw rot. (right turn)
12
Vm - ROTATION
ROTATE SUBJECT
PWR. GND (25V SUPPLY)
+15V
3
A6
741
7
6
2
4
-15V
R17
10K
1%
2
A7
741
7
+15V
6
3
4
-15V
1K
5%
R20
4.7K
R19
2N3741
Q2
1W
240Ω, 5%
1W
R26
Q12
10
5W
2N3716
-25V
R27
240Ω
L
5%

Figure C-6: Engineering Specification for Bimodal Simulator.

DRIVER VEHICLE ROTATION
AND CONFLICT APPROACH
CONTROL (Sh. 1 Of 2, Bd.1)


-15V
ROTATION OF CAR
CW Rot. of Car
15
+15V
3
2
7
6
4
A8
741
-15V
R30
50K
CW
CAL θ ROTATION
R31
1K
5%
R32
10K
1%
A10
741
+Eθ
±9V=±90°
P
R33
4.7K
5%
STEERING WHEEL
(pot opposite shaft)
CW Steer (right turn)
16
A9
741
R34
50K
CAL θ STEERING
R35
1K
5%
R38
47K, 5%
100K
R36, 5%
VFWD
20
10K
5%
MANUAL SPEED SETTING FOR CONFLICT VEHICLE
CW
21
100K
R37, 5%
A11
741
VAPPROACH
17
HALT
CONFLICT APPROACH SPEED
1N457
R42
4.7K
5%
CAL
50K
R43
0.1
R40
10K
1%
A12
741
4
BMS
22K
5%
R41
4.7K
5%
1K
5%
R44
2N3767
Q3
1W
R47
240Ω, 5%
1W
R45
240Ω, 5%
1W
R46
240Ω
1W
5%
2N3741
Q4
R49
240Ω, 5%
1W
240Ω
R48, 5%
+25V
M
5W
2N3792
Q6
19
positive Vol. causes conf. Vehicle to approach
VM-APPROACH
Conflt SPEED
PWR GND (25V SUPPLY)
Q5
X
5W
2N3716
R4
-25V
R50
240Ω
5%
6.2V
Z
A
E
GND
+15V
-15V

DRIVER VEHICLE ROTATION
AND CONFLICT APPROACH
CONTROL (Sh. 2 of 2, Bd. 1)

Figure C-6: Engineering Specification for Bimodal Simulator (Continued).

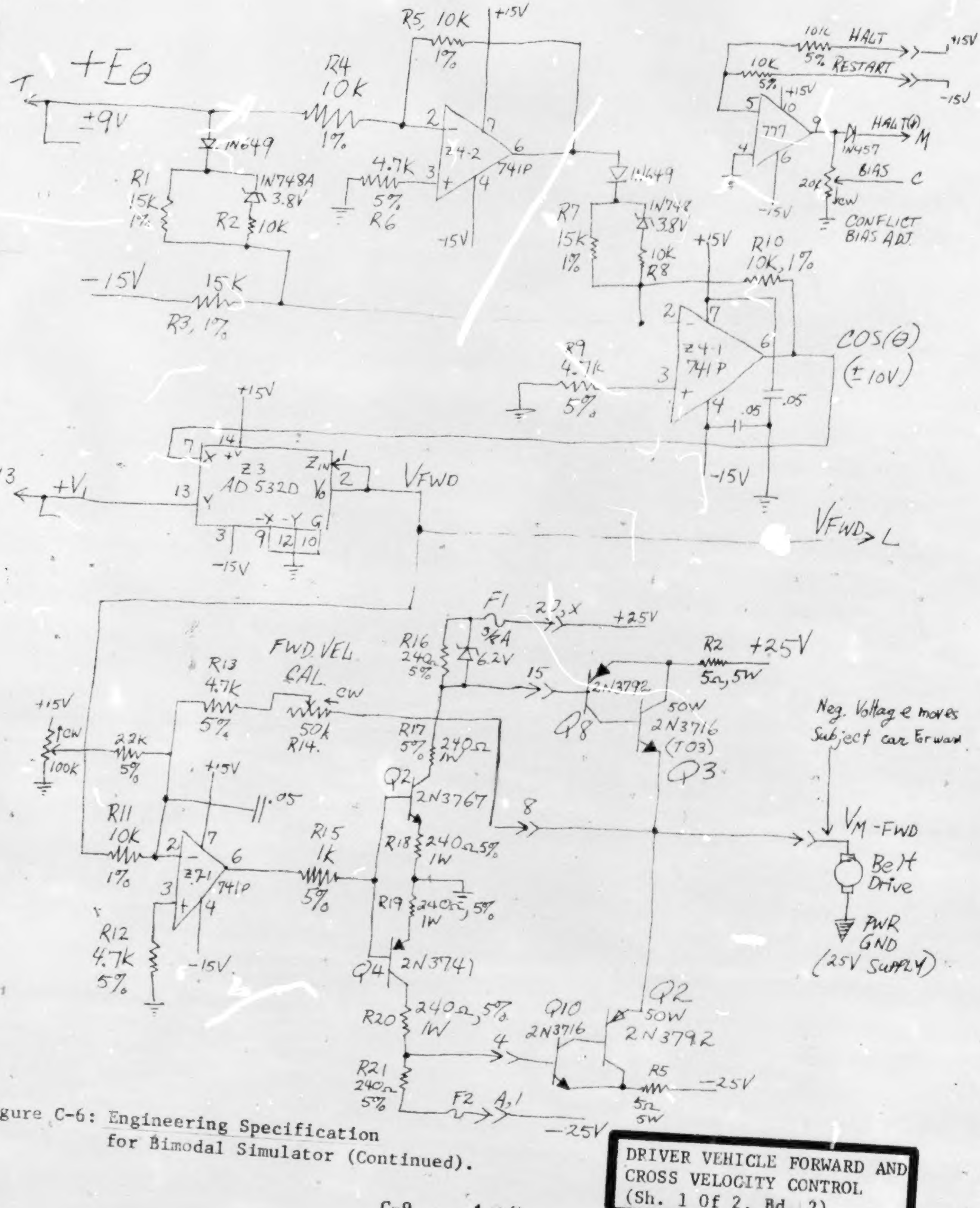
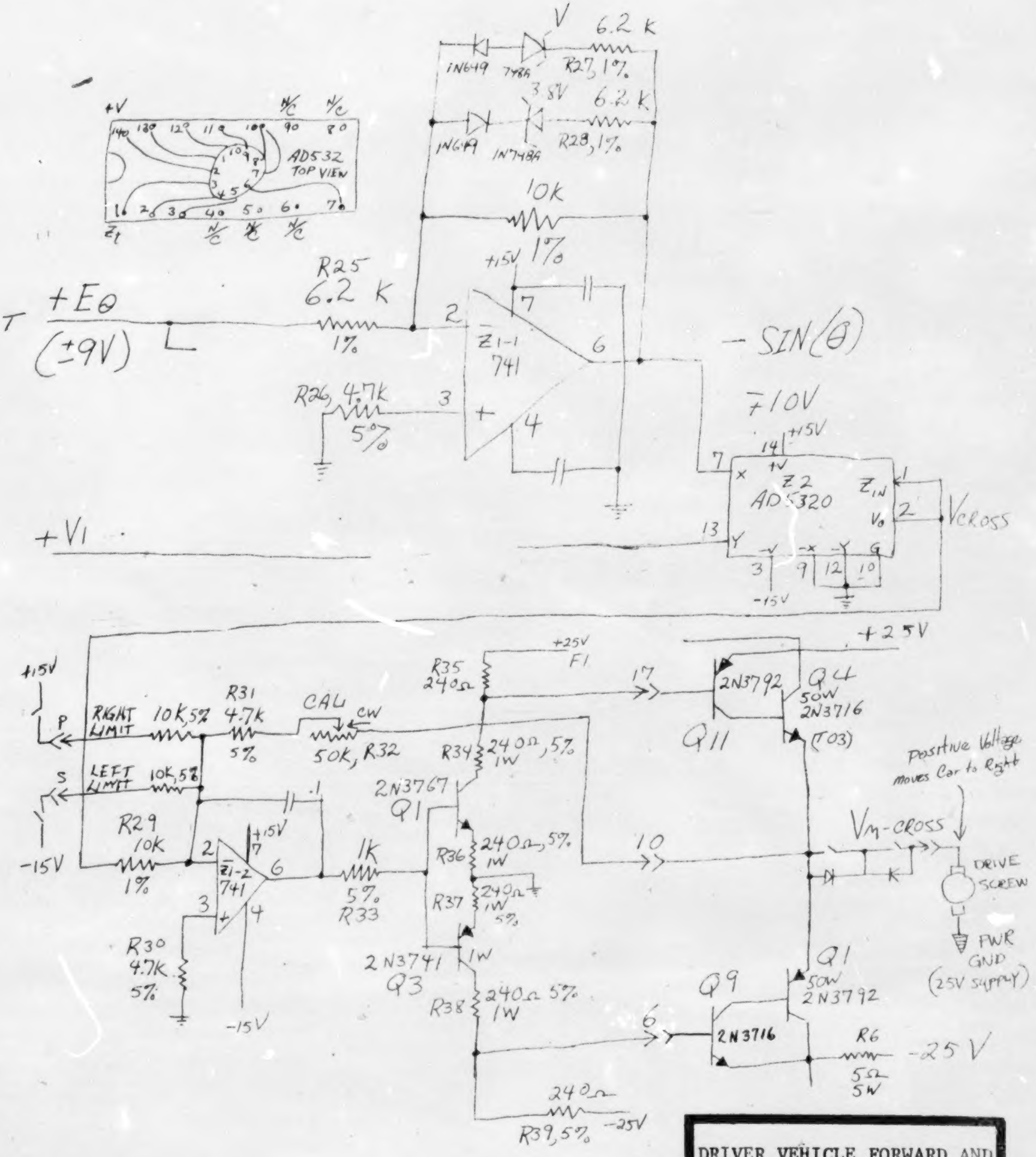

+Eθ
T
±9V
1N649
R1 15K 1%
1N748A 3.8V
R2 10K
-15V
15K
R3, 1%
R4 10K 1%
R5, 10K 1%
+15V
2
7
Z4-2
6
741P
3
4
4.7K 5% R6
-15V
1N649
R7 15K 1%
1N748 3.8V
10K R8
+15V
R10 10K, 1%
2
7
Z4-1 741P
6
3
4
R9 4.7K 5%
.05
.05
-15V
COS(θ) (±10V)
10K 5% HALT
10K 5% RESTART
+15V
-15V
5
10
777
9
4
6
-15V
1N457
HALT(θ) M
BIAS C
20K CW
CONFLICT BIAS ADJ.
+15V
14
7
X +V
Z3 AD532D
Z_IN 1
2
V_O
13 +V1
13 Y
3 9 12 10
-X -Y G
-15V
VFWD
VFWD L
F1 3/4A
27, X +25V
R16 240Ω 5%
6.2V
15
R2 5Ω, 5W
+25V
2N3792
Q8
50W 2N3716 (TO3)
Q3
Neg. Voltage moves Subject car forward
+15V
CW
100K
22K 5%
R13 4.7K 5%
FWD. VEL CAL
CW
50K R14
R17 5% 240Ω 1W
Q2
2N3767
8
VM -FWD
Belt Drive
PWR GND (25V SUPPLY)
+15V
.05
R11 10K 1%
2
7
Z-1
6
741P
3
4
R15 1K 5%
R18 240Ω 5% 1W
R19 240Ω, 5% 1W
R12 4.7K 5%
-15V
Q4 2N3741
R20 240Ω, 5% 1W
R21 240Ω 5%
4
Q10 2N3716
Q2 50W 2N3792
R5 5Ω 5W
-25V
F2 A, 1
-25V

Figure C-6: Engineering Specification for Bimodal Simulator (Continued).

DRIVER VEHICLE FORWARD AND
CROSS VELOCITY CONTROL
(Sh. 1 Of 2, Bd. 2)


+V
N/C
N/C
14
13
12
11
10
9
8
AD532
TOP VIEW
1
2
3
4
5
6
7
Z1
N/C
N/C
N/C
1N649
748A
V
6.2 K
R27, 1%
1N649
1N748A
3.8V
6.2 K
R28, 1%
10K
1%
+15V
R25
6.2 K
1%
+Eθ
(±9V)
2
Z1-1
741
6
7
3
4
R26, 4.7K
5%
-SIN(θ)
∓10V
+15V
14
+V
7
X
Z2
AD5320
ZIN
V0
1
2
VCROSS
13
Y
-V
-X
-Y
G
3
9
12
10
-15V
+V1
+25V
+25V
F1
R35
240Ω
17
2N3792
Q4
50W
2N3716
(T03)
Q11
+15V
P
RIGHT LIMIT
10K, 5%
R31
4.7K
5%
CAL
CW
50K, R32
R34
240Ω, 5%
1W
2N3767
Q1
S
LEFT LIMIT
10K, 5%
.1
R29
10K
1%
-15V
2
+15V
7
Z1-2
741
6
3
4
1K
5%
R33
R36
240Ω, 5%
1W
R37
240Ω
1W
5%
10
Positive Voltage moves Car to Right
VM-CROSS
K
DRIVE SCREW
PWR GND
(25V SUPPLY)
R30
4.7K
5%
-15V
2N3741
Q3
1W
R38
240Ω 5%
1W
Q1
50W
2N3792
Q9
6
2N3716
R6
-25V
5Ω
5W
240Ω
R39, 5%
-25V

DRIVER VEHICLE FORWARD AND
CROSS VELOCITY CONTROL
(Sh. 2 of 2, Bd. 2)

Figure C-6: Engineering Specification for Bimodal Simulator (Continued).

GPO 901-913

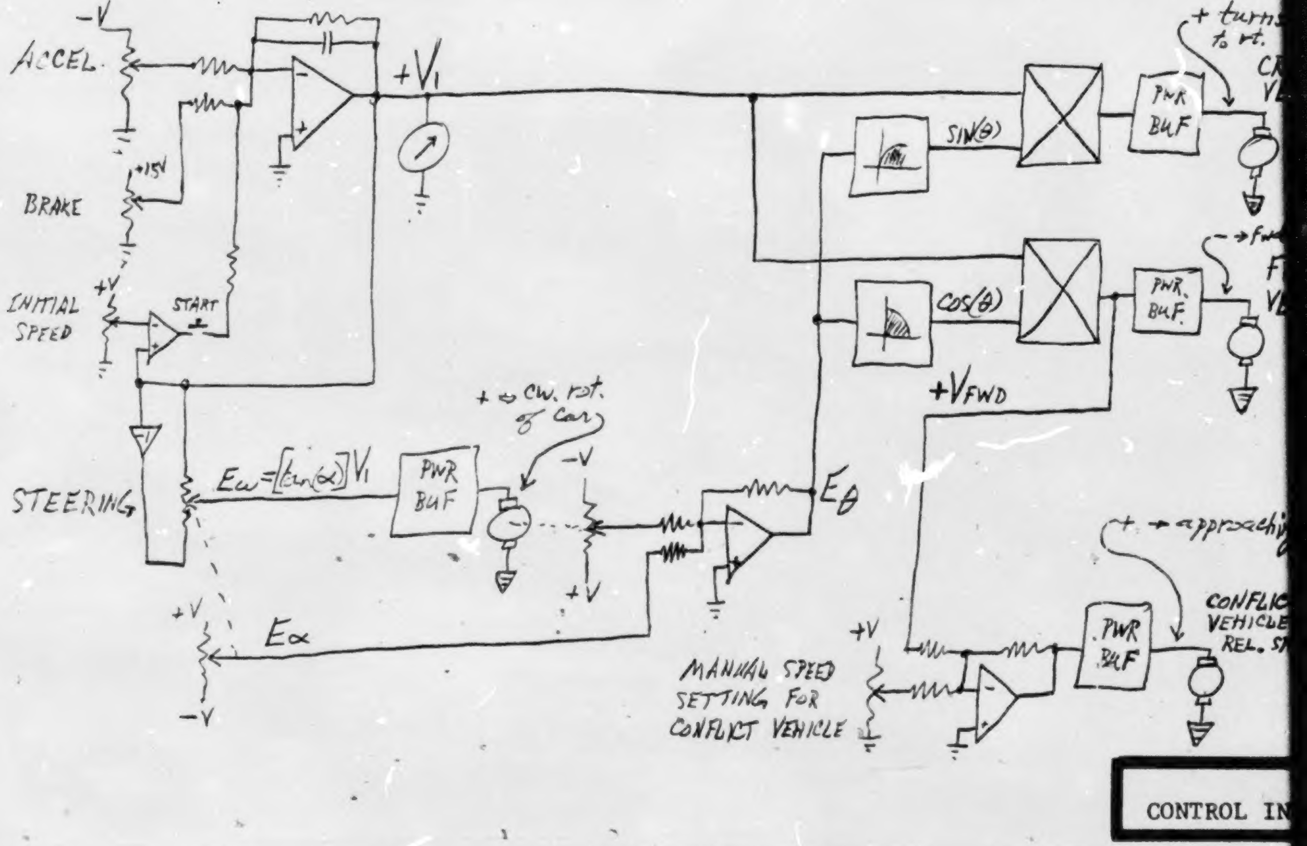
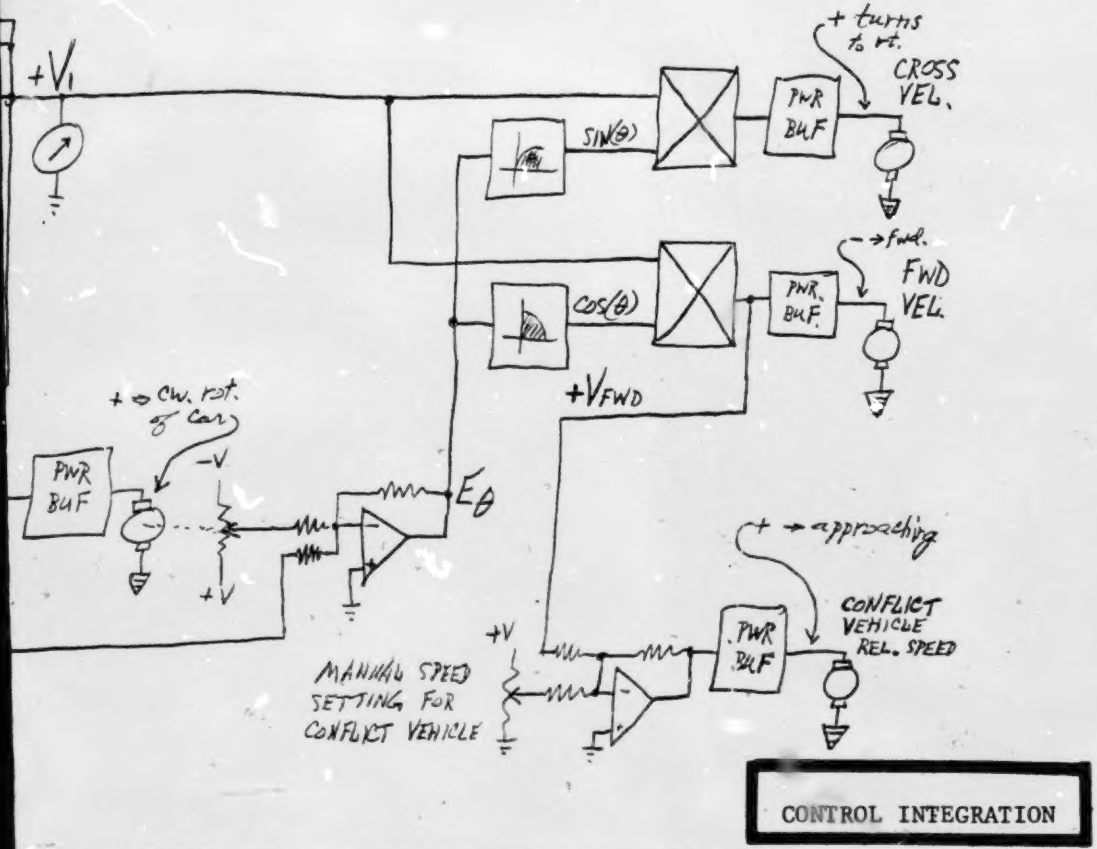

-V
ACCEL.
+15V
BRAKE
+V
INITIAL SPEED
START
$+V_1$
-1
STEERING
$E_\omega = [\tan(\alpha)] V_1$
PWR BUF
+ ⇒ CW. rot. of car
-V
+V
E_θ
E_α
+V
-V
SIN(θ)
COS(θ)
PWR BUF
PWR BUF
+ turns to rt.
CR
VE
→ fwd
F
VE
$+V_{FWD}$
+ → approachi
CONFLIC
VEHICLE
REL. S
+V
MANUAL SPEED SETTING FOR CONFLICT VEHICLE
PWR BUF
CONTROL IN

Figure C-6: Engineering Specification for Bimodal Simulator (Continued).



+V₁
+ turns to rt.
CROSS VEL.
PWR BUF
SIN(θ)
COS(θ)
→ fwd.
FWD VEL.
PWR. BUF.
+V_FWD
+ ⇒ cw. rot. of car
PWR BUF
−V
+V
E_θ
+ → approaching
CONFLICT VEHICLE REL. SPEED
PWR BUF
+V
MANUAL SPEED SETTING FOR CONFLICT VEHICLE
CONTROL INTEGRATION

ering Specification for Bimodal Simulator (Continued).